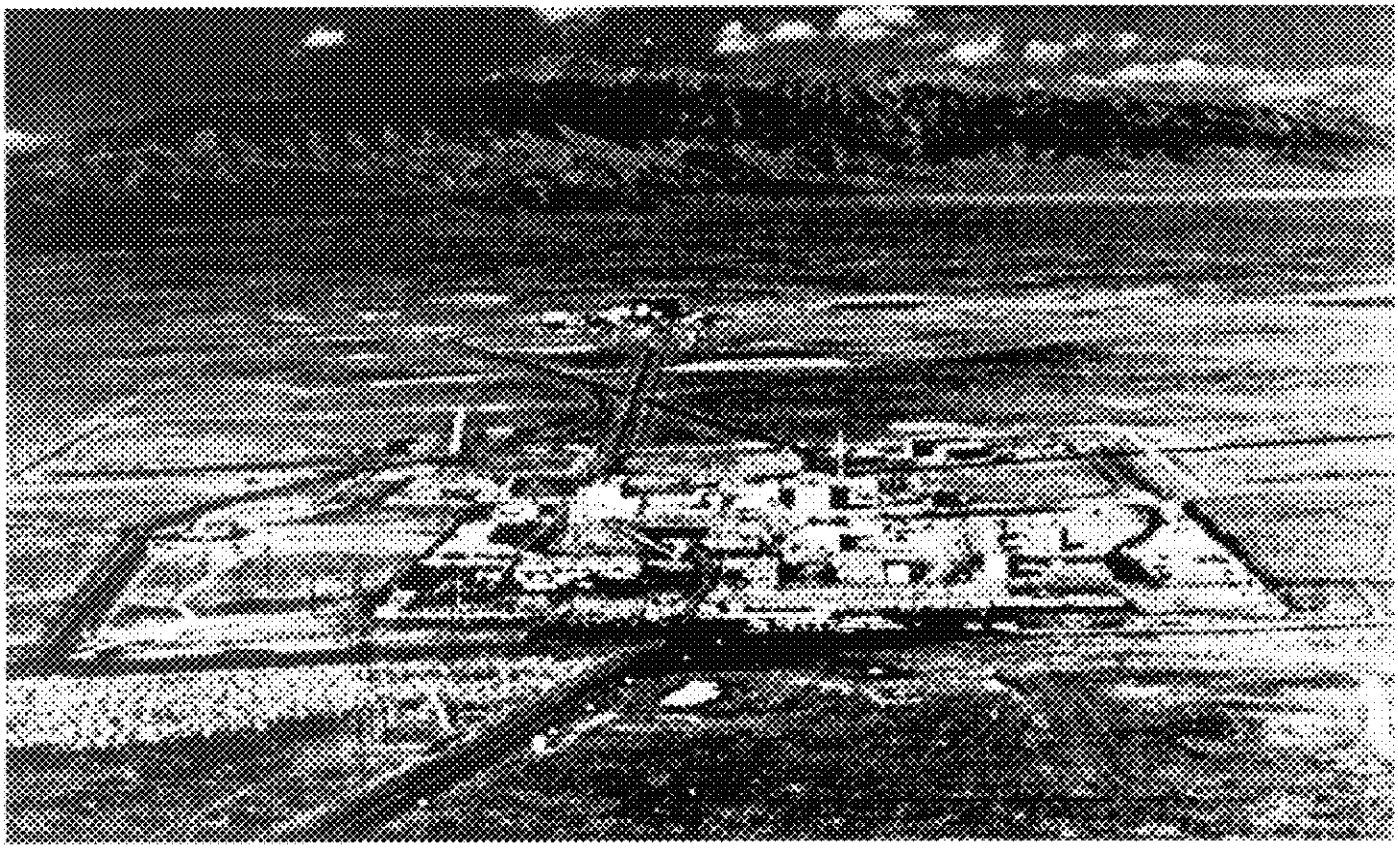
Idaho National Engineering Laboratory

DIVISION OF ENVIRONMENTAL QUALITY

Record of Decision

Declaration for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action



Operable Unit 1-07B
Waste Area Group 1
Idaho National Engineering Laboratory
Idaho Falls, Idaho

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DECLARATION OF THE RECORD OF DECISION

Site Name and Location

Technical Support Facility Injection Well (TSF-05) and
Surrounding Groundwater Contamination (TSF-23)—Operable Unit (OU) 1-07B
Test Area North (TAN) Miscellaneous No Action Sites OUs 1-01, 1-02, 1-06, and 1-09
Waste Area Group 1
Idaho National Engineering Laboratory
Idaho Falls, Idaho

Statement of Basis and Purpose

This decision document presents the selected final remedial action for OU 1-07B [the Technical Support Facility (TSF) Injection Well and Surrounding Groundwater Contamination] at the Idaho National Engineering Laboratory (INEL). Also included are a group of miscellaneous sites at TAN that were evaluated under the Track 1 process and found to require no action. These actions were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). These decisions are based on information in the Administrative Record for the site.

The lead agency for this decision is the U.S. Department of Energy (DOE). The U.S. Environmental Protection Agency (EPA) approves of this decision and along with the Idaho Department of Health and Welfare (IDHW) has participated in the evaluation of final remedial action alternatives. The IDHW concurs with the selected remedy.

Assessment of the Sites

Actual or threatened releases of hazardous substances from OU 1-07B, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to human health and welfare or the environment from future use of water taken from the TSF-05 Injection Well or from new drinking water wells placed within the plume where drinking water standards are exceeded.

The DOE has determined that no action is necessary for the TAN miscellaneous sites, which include portions of OUs 1-01, 1-02, 1-06, and 1-09. The sites in these four OUs have been categorized into underground storage tanks, potential soil contamination sites, and wastewater disposal sites. This decision is based on the results of Track 1 investigations that indicated these sites do not pose an unacceptable risk to human health. The EPA approves the DOE decision, and the IDHW concurs.

Description of the Selected Remedy

The OU 1-07B remedy presented in this ROD is intended to reduce potential risk to human health by reducing groundwater contamination and preventing the ingestion of contaminated groundwater by future residents at this site. The contaminants identified at concentrations above risk-based levels in the groundwater are organic compounds trichloroethene (TCE), cis- and trans-1,2-dichloroethene (DCE), and tetrachloroethene (PCE), and radionuclides strontium-90, tritium, cesium-137, and uranium-234. Operable Unit 1-07B is defined as that part of the groundwater

beneath TAN that has, or is expected to have, concentrations of TCE above the Safe Drinking Water maximum contaminant level (MCL) of 5 μg/L. Trichloroethene is being used as the indicator constituent for defining the groundwater plume because it is the most widely distributed contaminant of concern (COC) in the TAN groundwater. The selected remedial action for OU 1-07B is groundwater plume extraction and treatment of the greater than 25 μg/L TCE plume and hydraulic containment of the TSF-05 Injection Well hotspot with aboveground treatment. The reasonable timeframe for restoration of the aquifer to drinking water standards should not exceed 100 years. The TSF-05 Injection Well hotspot is the subsurface area in the immediate vicinity of the injection well containing the highest concentrations of dissolved contaminants as well as undissolved residual contaminants. The selected remedial action will be conducted in three phases:

- Phase A—Remove as much of the secondary source as possible from the vicinity of the TSF-05 Injection Well by physically and hydraulically stressing the well. The treatment system shall be designed such that concentrations of volatile organic compounds (VOCs) in the effluent are below MCLs before reinjection into the hotspot. All attempts will be made to operate this process as a hydraulically contained system. The air pollution control device will be operated in compliance with applicable or relevant and appropriate requirements (ARARs). Continue surging and stressing the well for 15 months unless Phase B is ready to begin before this date.

- Phase B—Prevent to maximum extent practicable, migration of contaminated groundwater beyond the hotspot at levels above MCLs, or for those contaminants for which an MCL does not exist, the contaminant concentration will be such that the total excess cancer risk posed by release of contaminated groundwater will be within the acceptable range of 10^{-4} to 10^{-6}. For aboveground treatment processes using reinjection of treated effluent, treatment shall, at a minimum, be sufficient to reduce the VOC concentration to below MCLs. Volatile organic compounds discharged to the atmosphere from Groundwater Treatment Facility (GWTF) operations will not exceed calculated emission rates.

- Phase C—Capture and/or treat a sufficient portion of the dissolved phase plume beyond the hotspot to provide for aquifer cleanup within 100 years of the date of ROD signature. For aboveground treatment processes using reinjection of treated effluent, treatment shall be designed to reduce the VOC concentration to below MCLs. If an MCL does not exist, the contaminant concentration will be such that the total excess cancer risk posed by the groundwater will be within the acceptable range of 10^{-4} to 10^{-6}. Volatile organic compounds discharged to the atmosphere from GWTF operations will not exceed calculated emission rates.

- Institutional controls and groundwater monitoring—Institutional controls shall be implemented to protect current and future users from health risks associated with ingestion of groundwater containing COC concentrations greater than MCLs or 10^{-4} to 10^{-6} risk-based concentrations for contaminants without MCLs. Institutional controls shall be maintained until COC concentrations fall below MCLs or 10^{-4} to 10^{-6} risk-based concentrations for contaminants without MCLs.

The purpose of Phase B is to remove, treat, or contain the contaminants to prevent continued downgradient migration from the source area. Knowledge gained during implementation of both Phase A and B will be used to determine the feasibility of removing, treating, or containing the source area to MCLs or other risk-based standards. If cleanup of contaminants in the source area does not appear technically practicable, a Technical Impracticability Waiver (TIW) will be pursued for the source area. If a TIW is granted, an alternative remedial strategy to prevent migration of

contaminants beyond the source area will be necessary. The actions required in this ROD are not inconsistent with foreseeable alternative remedial strategies.

Statutory Determination

The selected remedy for OU 1-07B is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that reduce toxicity, mobility, or volume as a principal element.

This action involves the injection to the aquifer of fluids with contaminant concentrations above MCLs which may contain radionuclides. Because this remedy will result in hazardous substances remaining onsite above Federal drinking water standards, a review will be conducted within 5 years of commencing the remedial action, in accordance with Section 121(c) of CERCLA to ensure the remedy continues to provide adequate protection of human health and the environment.

No further remedial actions are necessary for the portions of OUs 1-01, 1-02, 1-06, and 1-09 included in this ROD to ensure protection of human health and the environment. A statutory 5-year review will not be required, in accordance with Section 121(c) of CERCLA, because hazardous substances do not remain on these sites.

Signature sheet for the foregoing Record of Decision for the final remedial action for Operable Unit 1-07B [Technical Support Facility (TSF)-05 Injection Well and Surrounding Groundwater Contamination (TSF-23)] and Miscellaneous No Action Sites (Operable Units 1-01, 1-02, 1-06, and 1-09) at the Test Area North at the Idaho National Engineering Laboratory between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.

John Wilcynski
Manager,
Department of Energy Idaho Operations Office

9/10/95
Date

Signature sheet for the foregoing Record of Decision for the final remedial action for Operable Unit 1-07B [Technical Support Facility (TSF)-05 Injection Well and Surrounding Groundwater Contamination (TSF-23)] and Miscellaneous No Action Sites (Operable Units 1-01, 1-02, 1-06, and 1-09) at the Test Area North at the Idaho National Engineering Laboratory between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.

for Charles Findley

Chuck Clarke
Regional Administrator, Region 10
Environmental Protection Agency

8-18-5
Date

Signature sheet for the foregoing Record of Decision for the final remedial action for Operable Unit 1-07B [Technical Support Facility (TSF)-05 Injection Well and Surrounding Groundwater Contamination (TSF-23)] and Miscellaneous No Action Sites (Operable Units 1-01, 1-02, 1-06, and 1-09) at the Test Area North at the Idaho National Engineering laboratory between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.

Wallace N. Cory

8/17/95

Wallace N. Cory
Administrator
Division of Environmental Quality
Idaho Department of Health and Welfare

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ACRONYMS and ABBREVIATIONS

AAC	acceptable air concentration for noncarcinogens
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ANP	Aircraft Nuclear Propulsion
ARARs	applicable or relevant and appropriate requirements
BLM	Bureau of Land Management
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
COC	contaminant of concern
COCA	Consent Order and Compliance Agreement
CTF	Containment Test Facility
DCE	1,2-dichloroethene
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FET	final engine test
FFA/CO	Federal Facility Agreement and Consent Order
FS	feasibility study
gpm	gallons per minute
GWTF	Groundwater Treatment Facility
HQ	hazard quotient
IDAPA	Idaho Administrative Procedures Act
IDHW	Idaho Department of Health and Welfare
IET	Initial Engine Test
INEL	Idaho National Engineering Laboratory
LDR	land disposal restriction
LOFT	Loss-of-Fluid Test
MCL	maximum contaminant level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
OU	operable unit
PCE	tetrachloroethene
pCi/L	picocuries per liter
ppm	parts per million
ppmw	parts per million by weight

RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
SMC	Specific Manufacturing Capability
TAN	Test Area North
TCE	trichloroethene (also known as trichloroethylene)
TIW	Technical Impracticability Waiver
TSF	Technical Support Facility
VOC	volatile organic compound
WAG	Waste Area Group
WRRTF	Water Reactor Research Test Facility

OPERABLE UNIT 1-07B

DECISION SUMMARY

1. SITE NAME, LOCATION, AND DESCRIPTION

The Idaho National Engineering Laboratory (INEL) is a 2,305 km^2 (890 mi^2) Federal facility operated by the U.S. Department of Energy (DOE) and is located on the northern edge of the Eastern Snake River Plain. Approximately 11,700 people are employed by the INEL. The nearest offsite populations are in the cities of Terreton and Mud Lake [19 km (12 mi) east]; Arco [35 km (22 mi) west]; Blackfoot [61 km (38 mi) southeast]; Idaho Falls [79 km (49 mi) east]; and Pocatello [108 km (67 mi) southeast].

The Test Area North (TAN) complex is located approximately 80 km (50 mi) northwest of Idaho Falls in the northern portion of the INEL and extends over an area of approximately 30 km^2 (12 mi^2) (Figure 1-1). The Technical Support Facility (TSF) is centrally located within TAN and consists of several experimental and support facilities that are for conducting research and development activities on reactor performance. The TSF covers an area of approximately 460 × 670 m (1,500 × 2,200 ft) and is surrounded by a security fence. The TSF-05 Injection Well is located in the southwest corner of TSF (Figure 1-2). Three other major test facilities are located near TSF and are considered part of TAN. These facilities are the Specific Manufacturing Capability (SMC)/ Containment Test Facility (CTF) (formerly the Loss-of-Fluid Test (LOFT) Facility, the Initial Engine Test (IET) Facility, and the Water Reactor Research Test Facility (WRRTF) (Figure 1-2).

Current land use at the INEL is primarily nuclear research and development and waste management. Surrounding areas are managed by the Bureau of Land Management for multipurpose use. The developed area within the INEL is surrounded by a 1,295 km^2 (500 mi^2) buffer zone used for cattle and sheep grazing.

The INEL has semidesert characteristics with hot summers and cold winters. Normal annual precipitation is 23 cm (9.1 in.) per year, with estimated evapotranspiration of 15 to 23 cm (6 to 9 in.) per year. The Big Lost River and Birch Creek are the only natural surface water features present near TAN. TAN is located between the terminus of the Big Lost River and the terminus of Birch Creek. Because of irrigation and hydropower diversions and infiltration losses, stream flows in the Big Lost River and Birch Creek are typically depleted before reaching the INEL. Surface water can occur at TAN during and following periods of heavy rainfall and snowmelt, which generally takes place between January and April. However, the presence of diversion systems, and playas located at the terminal points of the Big Lost River and Birch Creek, typically prevent surface water from reaching TAN.

Twenty distinctive vegetative cover types have been identified at the INEL. Big sagebrush is the dominant species on the INEL. The variety of habitats on the INEL support numerous species of reptiles, birds, and mammals. Several bird species at the INEL that warrant special concern because of sensitivity to disturbance or their threatened status. These species include the ferruginous hawk (*Buteo regalis*), bald eagle (*Haliaeetus leucocephalus*), long-billed curlew (*Numenius americanus*), and the loggerhead shrike (*Lanius ludovicianus*). In addition, the Townsend's big-eared bat (*Plecotus townsendii*), and pygmy rabbit (*Brachylagus idahoensis*) are listed by the U.S. Fish and Wildlife Service as candidate species for consideration as threatened or endangered species. The ringneck snake, whose occurrence is considered to be INEL-wide, is listed by the Idaho Department of Fish and Game as a Category C sensitive species.

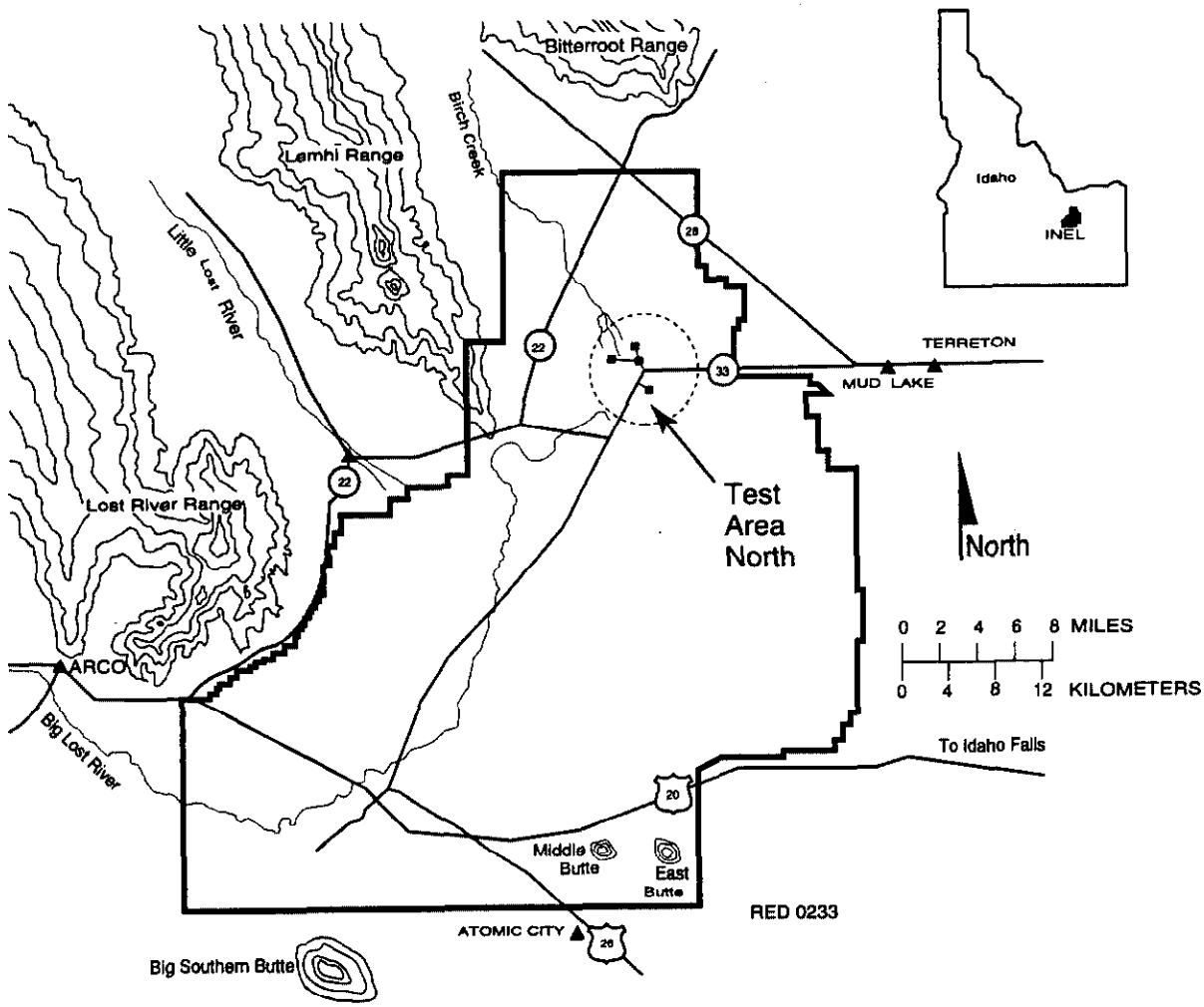


Figure 1-1. Location of the Idaho National Engineering Laboratory and the Test Area North.

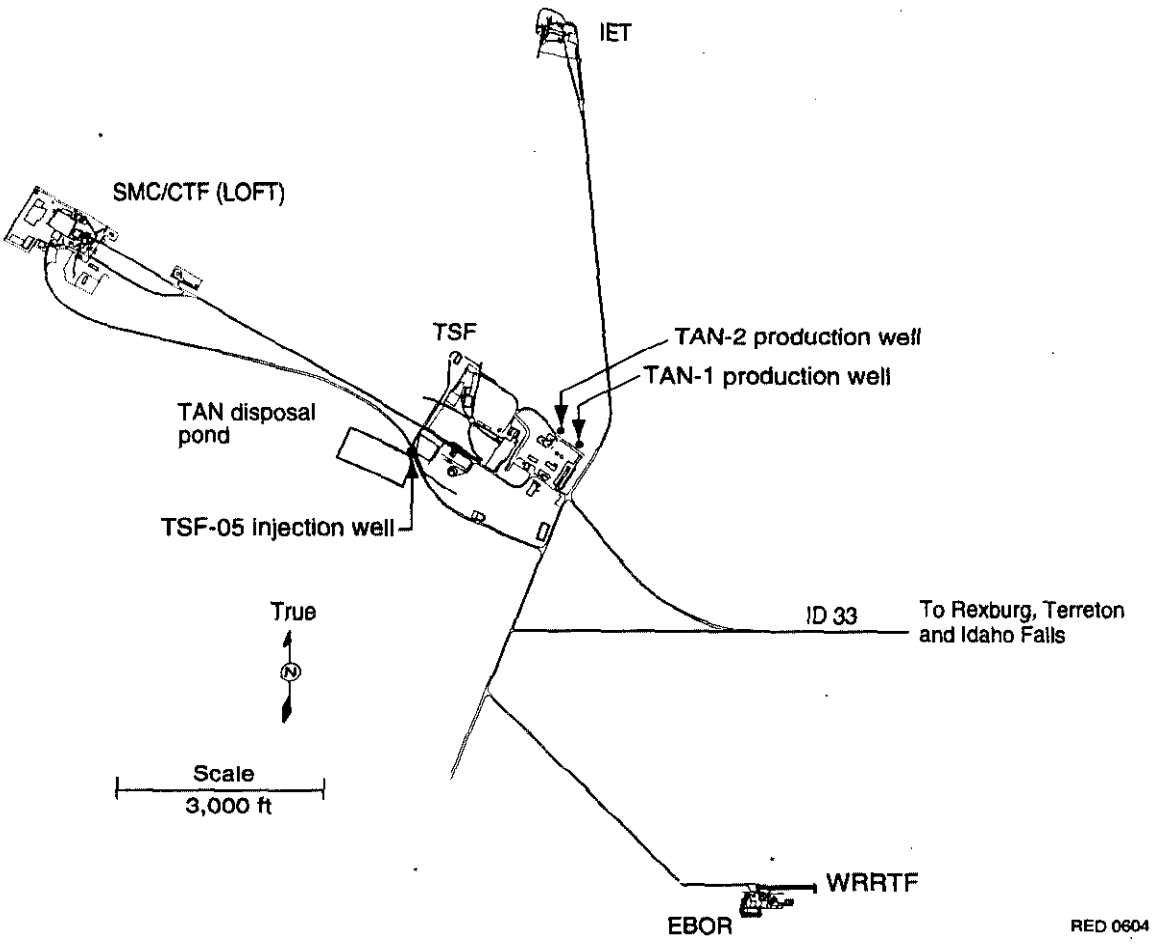


Figure 1-2. Test Area North facilities and location of the TSF-05 Injection Well.

2. SITE HISTORY AND ENFORCEMENT ACTIONS

2.1 Site History

Operations at TAN were initiated in the early 1950s to support the U.S. Air Force aircraft nuclear propulsion (ANP) project. The objectives of the ANP project were to develop and test various designs for nuclear-powered engines and fuels for use on aircraft. Four facilities were built at TAN including the TSF, IET, Low Power Test Facility/Experimental Beryllium Oxide Reactor (now WRRTF), and LOFT (now the SMC/CTF).

The principal source of groundwater contamination at TAN is the TSF-05 Injection Well located in the southwest corner of TSF (see Figure 1-2). The TSF-05 Injection Well was used from 1953 to 1972 to dispose of TAN liquid wastes into the fractured basalt of the Snake River Plain Aquifer. These wastes included organic, inorganic, and low-level radioactive wastewaters added to industrial and sanitary wastewater. Activities generating these wastes included efforts to develop a nuclear-powered aircraft and tests simulating accidents involving the loss of coolant from nuclear reactors.

Releases to TAN groundwater were first identified in 1987 when low levels of the organic compounds trichloroethene (TCE) and tetrachloroethene (PCE) were detected in the production wells

that supply drinking water to TSF. To mitigate potential risks to personnel at TAN, an air sparging system was installed on the drinking water supply system. Subsequent sampling of TAN aquifer monitoring wells confirmed the presence of organic compounds TCE, PCE, and 1,2-dichloroethene (DCE), and the radionuclides tritium (H-3), strontium-90 (Sr-90), cesium-137 (Cs-137), and uranium-234 (U-234) as contaminants above risk-based concentrations. Only organic compounds that are removed by the air sparging system have been consistently detected in the production wells at levels exceeding Federal drinking water standards. Strontium-90 has been detected above drinking water standards in production wells on two occasions; however, these data are suspect because subsequent sampling has not found elevated Sr-90 levels.

In 1990, an initial effort removed process sludge from the bottom 17 m (55 ft) of the TSF-05 Injection Well. Analytical results showed that the sludge contained high levels of organic contaminants (2% TCE) and radionuclides.

2.2 Enforcement

The TSF-05 Injection Well and the groundwater contamination at TAN were first identified and evaluated in accordance with the Resource Conservation and Recovery Act (RCRA) Corrective Action Requirements of the July 1987 Consent Order and Compliance Agreement (COCA) signed by DOE, the U.S. Environmental Protection Agency (EPA), and the U.S. Geological Survey. The COCA required DOE to conduct an initial assessment and screening of all solid waste and/or hazardous waste disposal units at the INEL, which resulted in the RCRA Corrective Action Program being implemented for the TAN groundwater.

On July 14, 1989, the INEL was proposed for listing on the National Priorities List (54 Federal Register 29820). The listing was proposed by the EPA under the authorities granted EPA by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, 40 Code of Federal Regulations (CFR) 300.425(b)(3), as amended by the Superfund Amendments and Reauthorization Act of 1986. The final ruling listing the INEL on the National Priorities List was published on November 21, 1989 (54 Federal Register 44184).

As a result of the INEL being listed on the National Priorities List, DOE, EPA, and the Idaho Department of Health and Welfare (IDHW) entered into a Federal Facility Agreement and Consent Order (FFA/CO), pursuant to CERCLA, in December 1991. The FFA/CO superseded the COCA and established a procedural framework for agency coordination and a schedule for all CERCLA activities conducted at the INEL.

At the TAN groundwater release site, pursuant to the FFA/CO Action Plan, DOE implemented an Interim Action and a remedial investigation (RI)/feasibility study (FS) to characterize the extent of contamination, to estimate human health and environmental risks, and to evaluate potential response actions. The Interim Action and RI/FS, designated as Operable Unit (OU) 1-07A and 1-07B, respectively, are parallel but separate actions.

In September 1992 the Interim Action Record of Decision (ROD) was signed. The objectives of the Interim Action were to reduce contaminant levels near the TSF-05 Injection Well and in the surrounding groundwater, and to measure aquifer parameters based on data from groundwater extraction and new monitoring wells. The major components of the OU 1-07A Interim Action included

- Extracting contaminated groundwater from TSF-05 Injection Well and nearby groundwater monitoring wells capable of capturing contaminated groundwater.

- Installing an onsite Groundwater Treatment Facility (GWTF) to reduce contaminants of concern (COCs) in the extracted groundwater to prescribed performance standards. The selected treatment was air stripping, carbon adsorption, and ion exchange.

- Installing two groundwater monitoring wells within the contaminant plume to monitor the effectiveness of the Interim Action. These wells can also be used as extraction wells to expedite the removal of contaminated groundwater.

- Monitoring the groundwater contaminant plume and the extraction/treatment system during groundwater extraction activities to track effectiveness of the system and ensure performance standards are achieved.

- Modifying the existing TAN disposal pond to receive the treated groundwater and ensure discharge water quality does not further degrade the underlying Snake River Plain Aquifer above maximum contaminant levels (MCLs). The pond was modified by constructing a berm to separate the western one-third of the pond from the remaining two-thirds. Treated groundwater from Interim Action activities was discharged to the western one-third.

- Implementing administrative and institutional controls to supplement engineering controls and minimize exposure to releases of hazardous substances during remediation.

The purpose of this ROD is to document the final remedial action for OU 1-07B.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

In accordance with CERCLA Sections 113(k)(2)(B)(i-v) and 117, community interviews were conducted with local officials, community residents, and public interest groups to solicit concerns and information needs and to learn how and when citizens would like to be involved in the CERCLA process. The information gathered during the community interviews and other relevant information provided the basis for development of the INEL-wide Community Relations Plan. This INEL-wide Community Relations Plan will continue to be implemented during this final response action to reflect the decisionmaking process under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300) and to ensure that appropriate public participation continues under the FFA/CO.

The presence of organic compounds in the groundwater at the TAN was first announced in a news release issued in November 1987. A second news release issued in September 1988 announced both the provision of an alternate source of drinking water for workers at TAN and the scheduled installation of an air sparging system to remove volatile organic compounds (VOCs) from the drinking water supply.

In accordance with CERCLA Sections 113(k)(2)(B)(i-v) and 117, the public was given the opportunity to participate in the remedy selection process.

The Notice of Availability for the proposed plan was published in April 1994 in the following newspapers: *The Post Register* (Idaho Falls), *The Idaho State Journal* (Pocatello), *Twin Falls Times News* (Twin Falls), *Idaho Statesman* (Boise), *The Lewiston Morning Tribune*, (Lewiston) *Idaho Free Press* (Nampa), *South Idaho Press* (Burley), and *Moscow-Pullman Daily News* (Moscow).

These advertisements identified public meeting locations and times. Personal phone calls were made to inform individuals and groups about the comment opportunity. The public was provided with copies of the proposed plan via a "Dear Citizen" letter transmitted to 5,600 groups and individuals on the mailing list.

The public comment period was scheduled from May 18 to June 18, 1994. Three public meetings were held on June 6, 8, and 9, 1994, in Idaho Falls, Boise, and Moscow. Representatives from the DOE, EPA, and IDHW were present at the public meetings in Idaho Falls and Boise to discuss the proposed plan, answer questions, and receive both written and oral public comments. Representatives from the DOE and IDHW were present at the public meetings in Moscow. For one half-hour before each meeting, representatives from the agencies were also available for informal discussions with the interested public. A court reporter was present at each meeting to record, verbatim, the proceedings. Copies of the transcripts from the public meetings are available for public review in the Information Repositories (which are located at the public libraries in Boise, Twin Falls, Pocatello, and Idaho Falls and the University of Idaho Library in Moscow) as part of the Administrative Record for this final response action.

A Responsiveness Summary has been prepared to address public comments as part of this ROD. All verbal comments given at the public meetings and all submitted written comments are repeated, verbatim, in the Administrative Record for the ROD. Those comments are annotated to indicate which response in the Responsiveness Summary addresses each comment.

A fact sheet was sent to the public in January 1995 to provide citizens with updated information on the TSF-05 Interim Action and subsequent impacts to the preferred alternative selected for OU 1-07B.

In accordance with CERCLA Section 113(k)(1), an Administrative Record was established to provide the basis for selection of the remedial action. The Administrative Record is available for public review at the DOE Public Reading Room located at the INEL Technical Library in Idaho Falls. Copies of the Administrative Record are available for public review at the public libraries at Boise, Idaho Falls, Pocatello, Twin Falls, and the University of Idaho Library in Moscow.

Persons on the mailing list will receive a notice of availability stating the signed ROD is available. Copies of the ROD and the Responsiveness Summary will be placed in the Administrative Record and in the information repositories, and will be provided to the public upon request.

4. SCOPE AND ROLE OF OPERABLE UNIT

To better manage the investigations needed to determine appropriate remedial actions, the INEL has been divided into 10 Waste Area Groups (WAGs). Within each WAG, known or suspected areas of contamination are assigned to an OU as a means of controlling investigation and cleanup activity. This strategy allows the EPA, IDHW, and DOE to focus available cleanup resources on those areas that could potentially pose a risk to human health and the environment. The TAN complex, designated as WAG 1, consists of 11 OUs. The Interim Action has been designated OU 1-07A. The groundwater in the immediate vicinity of TAN, which has TCE concentrations greater than the MCL of 5 micrograms per liter (μg/L), has been designated OU 1-07B.

Sufficient characterization data are available to identify OU 1-07B as a potential risk to human health and the environment because of the excess presence of organic contaminants including TCE, PCE, and DCE and several radionuclides including Sr-90, Cs-137, U-234, and H-3 in the

groundwater underlying TAN. This final response action is intended to ensure that offsite populations and potential future onsite residents will not be at risk.

5. SUMMARY OF SITE CHARACTERISTICS

5.1 Geology

The subsurface geology of TAN is characterized by basalt flows with sedimentary interbeds, overlain by fine-grained sediments. Geologic descriptions from wells drilled in the TAN area indicate that the basalt is highly variable, from dense to highly vesicular basalt and from massive to highly fractured basalt. Individual flow units have a median thickness of approximately 4.5 m (15 ft). The sedimentary interbeds at TAN have a median thickness of approximately 1.2 m (4 ft) and are thinner than interbeds found elsewhere on the INEL.

There are two main interbeds in the TAN area. The P-Q and Q-R interbeds both consist of clay or silt. Because interbed sediments at TAN are comprised mostly of fine-grained materials with low permeabilities and high absorption capacities, their presence within the basalt section is important with respect to retarding contaminant migration.

The P-Q interbed, located approximately 61 m (200 ft) below land surface (bls) near the TSF-05 Injection Well, has been encountered in only about 50% of the wells drilled deep enough at TAN to show the interbed; therefore, it appears to be laterally discontinuous. The range of thickness of the P-Q interbed (when present) appears to be approximately 1 to 4 m (3 to 14 ft).

The Q-R interbed, located at approximately 134 m (440 ft) bls near the TSF-05 Injection Well, is considered laterally continuous throughout the TAN region. This is supported by (a) geological data obtained during borehole drilling, (b) basalt flow age dates from above and below the interbed, and (c) hydraulic head measurements collected from wells during both sampling and TAN production well pumping. Ten wells have been drilled deep enough to encounter the Q-R interbed at TAN. In all 10 cases, the interbed was encountered. Basalt flows above and below the interbed show a large age difference. The 1.3-million year hiatus between basalt flows could have provided sufficient time for a relatively thick, laterally continuous sedimentary interbed to be deposited. Borehole data indicates that the total thickness of the Q-R interbed is approximately 12 m (40 ft). Hydraulic head data collected from wells completed both above and below the Q-R interbed also support the interpretation that the interbed is laterally continuous at TAN. Water level measurements were collected during sampling and TAN production well pumping. During these events, hydraulic head changes were noted in wells completed above the Q-R interbed but not in adjacent wells completed below the interbed. The geological and hydrological data collected thus far suggest that the Q-R interbed is continuous and impedes the vertical movement of water and contaminants in the aquifer.

5.2 Hydrology

The Snake River Plain Aquifer, one of the largest and most productive groundwater resources in the United States, underlies the INEL. The aquifer is listed as a Class I aquifer, and EPA has designated it as a sole source aquifer. The Snake River Plain Aquifer is defined as the series of saturated basalt flows and interlayered pyroclastic and sedimentary materials underlying the eastern Snake River Plain. The aquifer is approximately 325 km (200 mi) long, 65 to 95 km (40 to 60 mi) wide, and covers an area of approximately 25,000 km^2 (9,600 mi^2). As much as 2.5×10^{12} m^3 (2 billion acre · ft) of water may be stored in the aquifer—approximately 6.2×10^{11} m^3

(500 million acre · ft) of which are recoverable. The aquifer discharges approximately 8.8×10^9 m^3 (7.1 million acre · ft) of water annually to springs and rivers.

The regional flow of the Snake River Plain Aquifer is to the south-southwest; locally, the direction of groundwater flow is affected by recharge from rivers, surface water spreading areas, pumping of the aquifer, and heterogeneities in the aquifer. Figure 5-1 is a regional water table map of the TAN area showing the inferred direction of groundwater flow. The hydraulic gradient for the regional aquifer in the vicinity of TAN is about 0.2 m/km (1 ft/mi). A major feature that should be noted in Figure 5-1 is that the regional water-table gradient is very flat in the TAN area, which could be the result of high transmissivity. Under the conditions of a flat water-table gradient, the influence of the production wells on the contaminant source (TSF-05 Injection Well) is strong and may cause major flow disruptions or times of flow reversal within the aquifer in the vicinity of TAN. The average depth to water at TAN is approximately 61 m (200 ft).

There are five production wells at TAN that provide groundwater for drinking, industrial, and other facility uses (e.g., lawn watering, fire protection). Two wells [final engine test (FET)-1 and FET-2] are located near LOFT, west of the TSF, and are outside of the OU 1-07B groundwater contaminant plume. The production wells TAN-1 and TAN-2 are located on the north side of TSF and supply water for operations at TSF. Low levels (1–8 μg/L) of TCE have been detected in wells TAN-1 and TAN-2. The fifth production well (ANP-8) is located at WRRTF, southeast of TSF. Low levels of volatile organics have also been detected in this well.

5.3 Nature and Extent of Contamination

Information from characterization activities at TAN suggests that potential airborne, surficial, and vadose zone sources of contamination to the groundwater are probably insignificant contributors to the groundwater contamination at TAN. Of the potential surface and vadose zone sources that could have been expected to have received TCE and related volatile organics, an evaluation of waste generation and disposal practices, and environmental characterization data showed no contamination and no sign of contaminant migration that could be related to the TAN groundwater contamination. The only other possible sources of groundwater contamination are three injection wells. These injection wells include the WRRTF-05 Injection Well, the IET-06 Injection Well, and the TSF-05 Injection Well. These three possible sources have been investigated, and the available evidence suggests that the TSF-05 Injection Well is the source of contamination to the groundwater at TAN. A detailed evaluation of these and other potential sources of contamination can be found in the RI report *Remedial Investigation Final Report with Addenda for the Test Area North Groundwater Operable Unit 1-07B at the Idaho National Engineering Laboratory, Volume 1*, EGG-ER-10643, January 1994, which is located in the Administrative Record.

The TSF-05 Injection Well was drilled in 1953 to a depth of 93 m (310 ft) to dispose of liquid effluent generated from the ANP project. The TSF-05 Injection Well has a 30-cm (12-in.) diameter casing to 93 m (310 ft) and is perforated from 55 to 74 m (180 to 244 ft) and 82 to 93 m (269 to 305 ft) bls. The depth to groundwater is about 63 m (206 ft) bls. The well was last used as a disposal site in September 1972, after which wastewaters were diverted to the TAN disposal pond.

Discharges to the well included organic sludges, treated sanitary sewage, process wastewaters, and low-level radioactive waste streams. Historical records provide little definitive information on the types and volumes of organic wastes disposed via the injection well. It is estimated that as little as 1,325 L (350 gal) and as much as 97,161 L (25,670 gal) of TCE were disposed in the well during its period of operation. An evaluation of the solvent usage at TAN concluded that the waste discharged

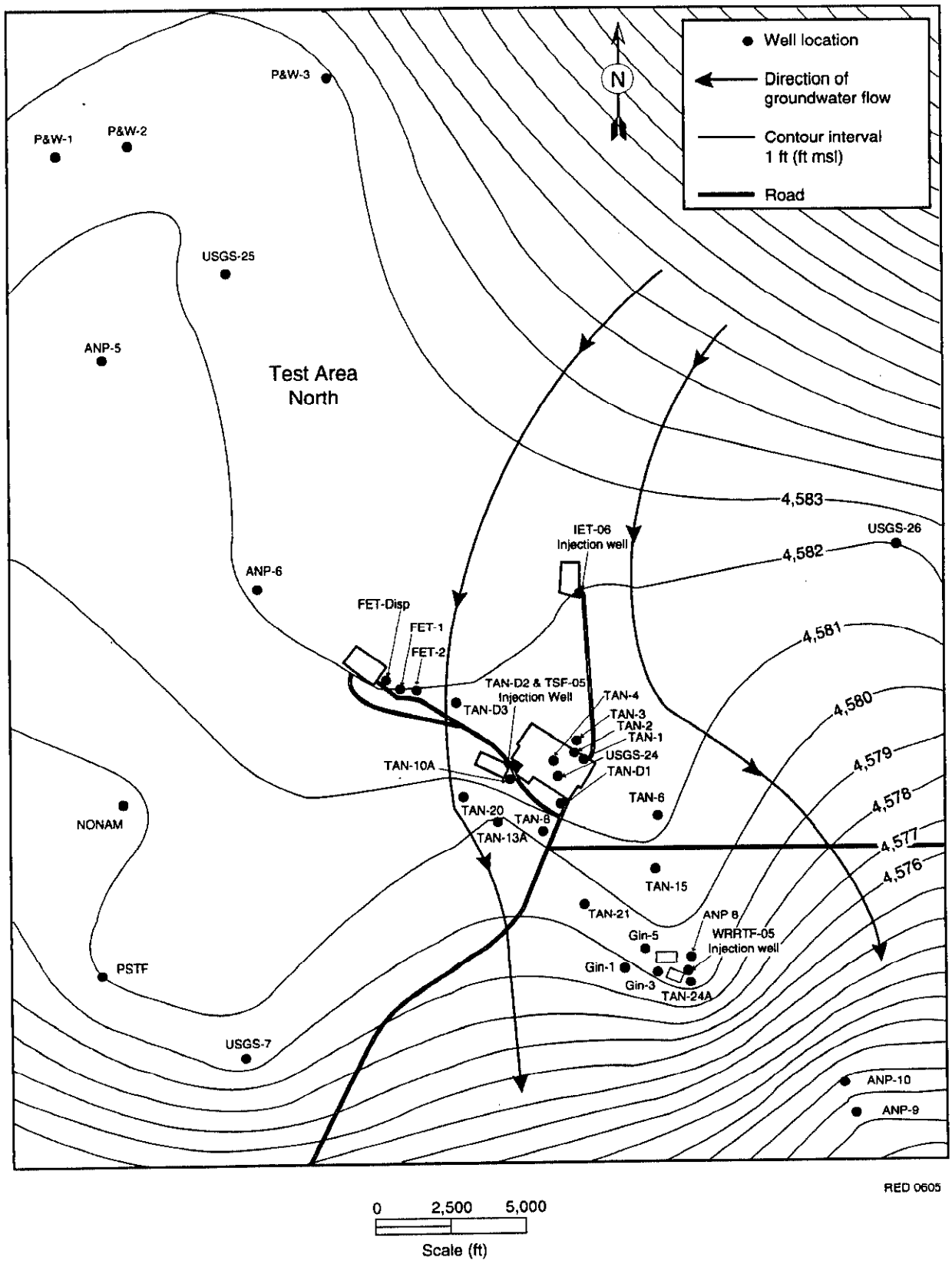


Figure 5-1. Water table map of the Test Area North area showing the inferred groundwater flow direction (December 1990).

to the aquifer through the injection well was not a listed hazardous waste because the organic chemicals in the waste were not used as solvents and disposal practices were not documented.

On the basis of results from groundwater quality analyses from the injection well, as well as analytical and radiological analysis of sediment/sludge removed from the well in 1990, the TSF-05 Injection Well is considered the major source of groundwater contamination at TAN. Since 1988, TCE and other VOCs and radionuclides have been detected as a result of several sampling efforts by the U.S. Geological Survey and DOE. Groundwater quality data from sampling events performed between 1988 and 1991 showed TCE concentrations at the TSF-05 wellhead from 4,100 to 28,000 μg/L.

New groundwater monitoring wells were installed, and new and existing wells were sampled as part of the RI conducted in 1992. As a result of this investigative effort, the horizontal and vertical extent of groundwater contamination was delineated. Extensive drilling, aquifer testing, and sampling suggests that the majority of contamination is limited to the uppermost portion of the aquifer underlying TAN, and that the Q-R interbed represents a hydrologic barrier that separates the upper aquifer above the Q-R interbed from lower aquifers and influences the migration and distribution of contaminants. Two groundwater monitoring wells were installed below the Q-R interbed as part of the 1992 RI. One well is located within the TSF, approximately halfway between the TSF-05 Injection Well and the TAN production wells. The second well is located approximately halfway between the TSF and the WRRTF. Only low concentrations (less than MCLs) of VOCs were measured below the Q-R interbed. Trichloroethene concentrations in groundwater samples collected from the TSF-05 Injection Well during the 1992 RI ranged from 4,100 to 8,300 μg/L.

Estimates of the amount of TCE dissolved in the groundwater account for only a small amount of the TCE potentially disposed to the TSF-05 Injection Well. This and other evidence (e.g., groundwater concentrations of TCE at the injection well) suggest that a secondary or residual source of undissolved contaminants is very likely present in the vicinity of the TSF-05 Injection Well. In this document, the term secondary source is used to indicate the presence of one or all of the following: (a) sludge-entrained TCE, (b) water-sludge-TCE emulsions, and/or (c) free nonaqueous phase liquids or small pools (residual saturation) in dead-end fractures or on basalt flowtops. The TSF-05 hotspot is defined as including the secondary source and highly contaminated groundwater (i.e., with TCE concentrations greater than 5,000 μg/L) in the immediate vicinity of the TSF-05 Injection Well. Evidence does not support the existence of a free phase dense nonaqueous phase liquid.

Table 5-1 shows the concentration ranges of the COCs for OU 1-07B based on 1992 RI groundwater sampling, and Figures 5-2, 5-3, and 5-4 show the distribution of TCE, DCE, and H-3 within the groundwater at TAN. Distribution maps were not included for PCE, Cs-137, Sr-90, and U-234 because the distribution of these contaminants is mainly limited to the area in the immediate vicinity of the TSF-05 Injection Well. A full description of contaminant concentrations in aquifer monitoring wells and the contaminant distributions can be found in the RI report.

Analytical results from groundwater samples collected from the Interim Action monitoring wells TAN-25 and TAN-26 [7.6 and 15.2 m (25 and 50 ft) from TSF-05, respectively] and the TSF-05 Injection Well in June 1993 (Table 5-2) showed TCE (290–17,000 μg/L), DCE (180–9,300 μg/L), Cs-137 [less than the detection limit–2,030 picocuries per liter (pCi/L)], U-234 (17 pCi/L), and Sr-90 (8.2–630 pCi/L), and PCE (5–39 μg/L). In general, analytical results from the June 1993 sampling event are similar to those found during the 1992 RI (Table 5-1) for the TSF-05 Injection Well.

Table 5-1. Contaminants of concern and range of concentrations in the Test Area North groundwater.[a]

Chemical	TAN monitoring wells	TAN production wells	TSF-05 Injection Well	MCL[b]
Organic compounds (μg/L)				
PCE	<1–71	<1–3	<500[c]	5
TCE	<1–1,400	<1–16	4,100–8,300	5
cis-1,2-DCE	<1–38	<1	5,600–5,800	70
trans-1,2-DCE	<1–7	<1	3,200–3,400	100
Radionuclides (pCi/L)				
Sr-90	<1–470	<1–4	610–640	8
H-3	<500–9,800	420	14,700–15,800	20,000
Cs-137	<30–32	<30	1,940–2,240	119
U-234	<1	<1	5–7	30

a. Concentration ranges were derived from 1992 RI analytical results; < indicates less than detection limit.

b. MCL = maximum contaminant level per Federal drinking water standards. The proposed MCL for U-234 is for the U-234, -235, and -238 series. The proposed MCL for Cs-137 is derived from a corresponding 4 mrem/yr effective dose equivalent to the public, assuming lifetime intake of 2 L/day of water.

c. A dilution factor of 500 was used during sample analysis, raising the detection limit for PCE to 500 μg/L. More recent sampling (June 1993) used a lower detection limit (see Table 5-2).

Table 5-2. Results of June 1993 sampling of TSF-05 Injection Well and Interim Action Wells TAN-25 and TAN-26.

Chemical	TSF-05 Injection Well	TAN-25 Monitoring Well	TAN-26 Monitoring Well	MCL[a]
Organic Compounds (μg/L)				
PCE	20–22	39	5J–15J	5
TCE	5,900–11,000J[b]	17,000	290–670	5
Total DCE	6,500–9,300J	4,800	180–340	70
Radionuclides (pCi/L)				
Sr-90	520–630	380	8.2–8.6	8
H-3	18,700–18,800	14,200	4,700–4,800	20,000
Cs-137	2,010–2,030	147	<30[c]	119
U-234	17	10	2.3–3.4	30

a. MCL = maximum contaminant level per Federal drinking water standards. The proposed MCL for U-234 is for the U-234, -235, and -238 series. The proposed MCL for Cs-137 is derived from a corresponding 4 mrem/yr effective dose equivalent to the public, assuming lifetime intake of 2 L/day of water.

b. The "J" validation flag indicates that the analyte was positively identified in the sample, but the associated value is only an estimate of the amount actually present in the environmental sample.

c. < indicates less than detection limit.

Table 5-3. Validated results from March and June 1994 quarterly sampling and analysis showing the range of contaminant concentrations.[a]

Contaminant	TSF-05 Injection Well	TAN-25 Monitoring Well	TAN-26 Monitoring Well	MCL[b]
Organic Compounds (μg/L)				
PCE	110	<200[c]	14–19	5
TCE	12,000–32,000	5,900–9,300	710–1,000	5
cis-1,2-DCE	3,200–7,500	890–3,500	230–420	70
trans-1,2-DCE	1,300–3,900	450-2,000	17–33	100
Oil and grease (mg/L)	<5–10	<5–7.1	<5–46.3[d]	None
Radionuclides (pCi/L)				
Strontium-90[e]	530–1,880	380-440	2–4	8
Tritium	14,900–15,300	7,500–10,000	3,500–3,700	20,000
Uranium-234	5.2–7.7	7	1.7	30
Uranium-235	<0.2	—	—	30
Uranium-238	<0.1-0.43	0.64	1.4	30
Americium-241/ Plutonium-238	<0.2	<0.2	<0.2	None
Plutonium-239/240	<0.2	<0.2	<0.2	None
Cesium-137	1,600–2,150	90–300	<30	119
Cobalt-60	23	<20	<20	100[f]

a. Key: — = not sampled; < indicates less than detection limit.

b. MCL = maximum contaminant level per Federal drinking water standards. The proposed MCL for U-234 is for the U-234, -235, and -238 series. The proposed MCL for Cs-137 is derived from a corresponding 4 mrem/yr effective dose equivalent to the public, assuming lifetime intake of 2 L/day of water.

c. Dilution factors of 1,000 and 200 were used during the March and June sample analysis, respectively. These dilution factors raised the detection limit for PCE to 1,000 μg/L for the March 1994 analysis and 200 μg/L for the June 1994 analysis.

d. A duplicate sample of the 46.3 was taken, which was <5 mg/L.

e. Range includes only unfiltered Sr-90 samples.

f. EPA (1977), Primary Drinking Water Standard.

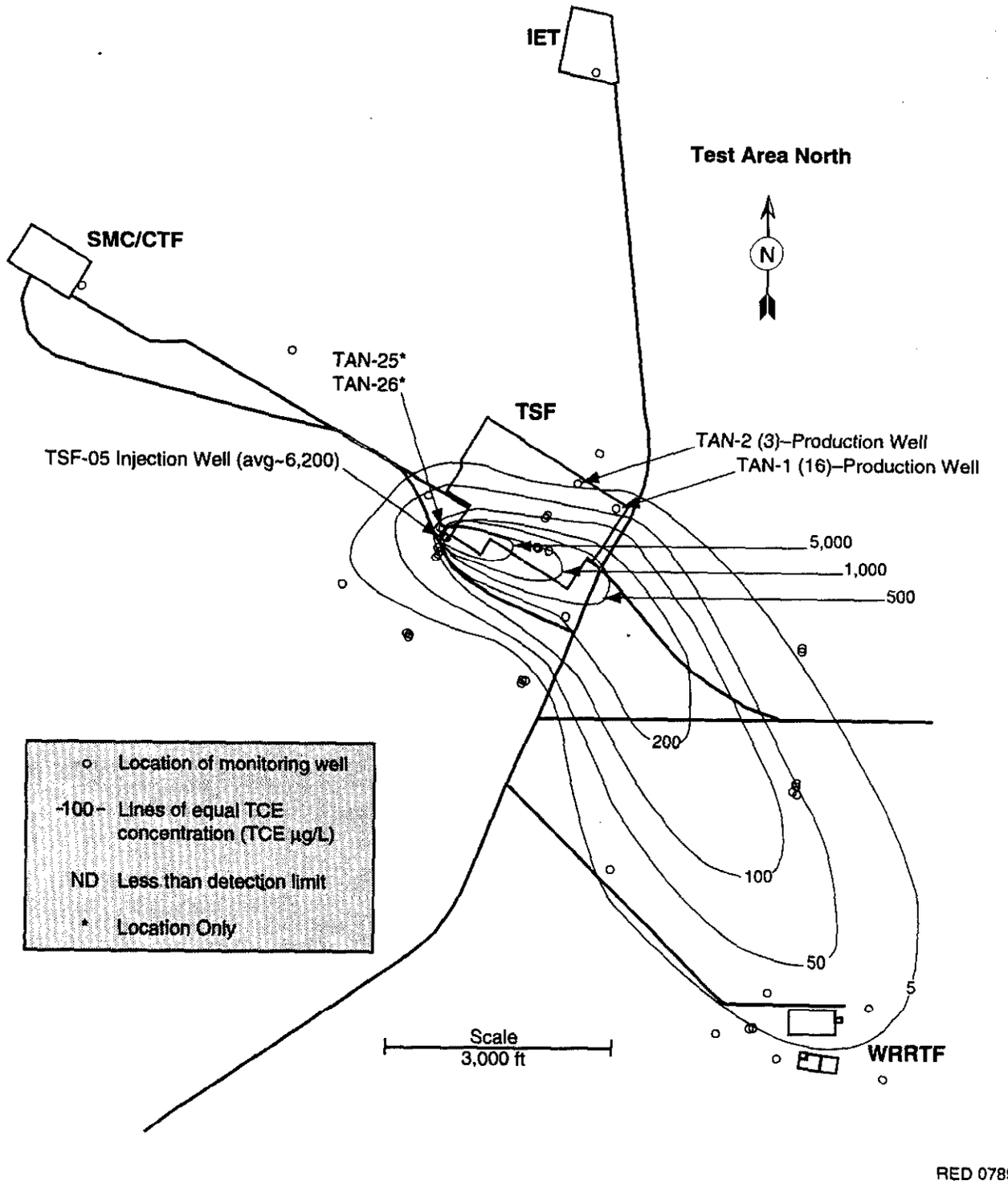


Figure 5-2. Iso-concentration map for TCE (1992 analytical data). Note: Well locations have been corrected from the iso-concentration map presented in the OU 1-07B RI and FS reports.

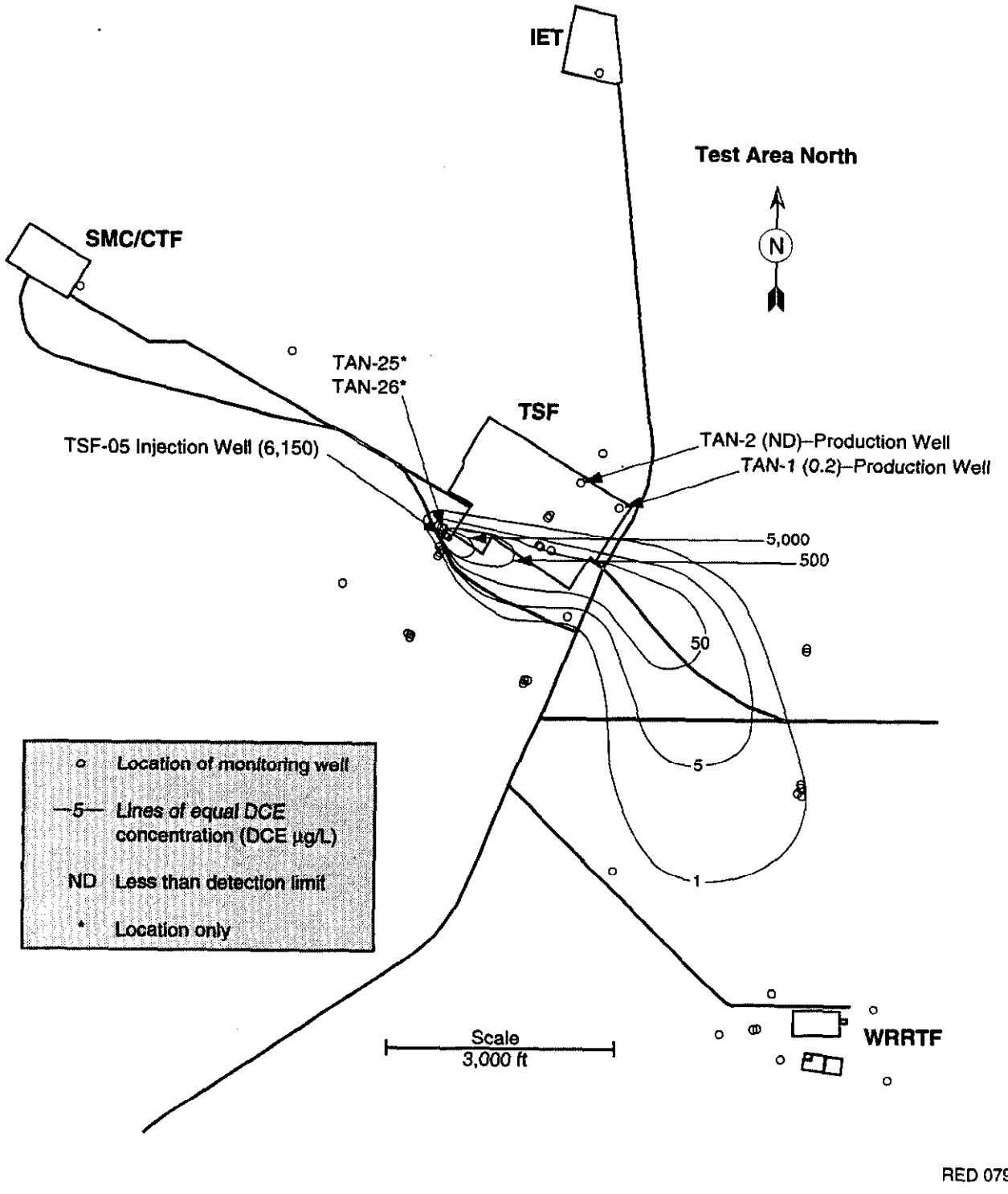


Figure 5-3. Iso-concentration map for DCE (1992 analytical data). Note: Well locations have been corrected from the iso-concentration map presented in the OU 1-07B RI and FS reports.

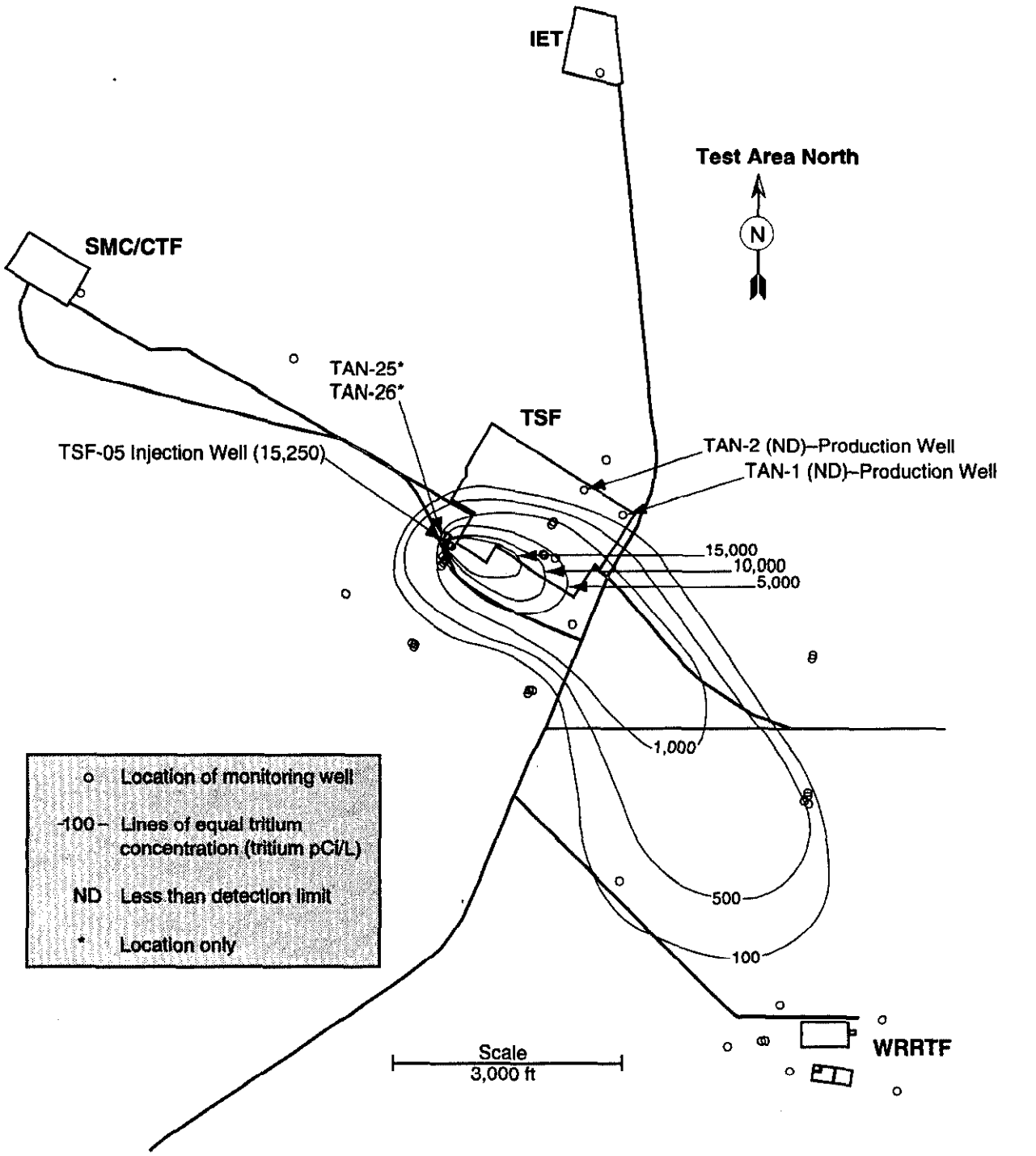


Figure 5-4. Iso-concentration map for tritium (1992 analytical data). Note: Well locations have been corrected from the iso-concentration map presented in the OU 1-07B RI and FS reports.

Analytical results from groundwater samples collected for the first and second quarters of 1994 for TAN-25, TAN-26, and the TSF-05 Injection Well during the OU 1-07A Interim Action are presented in Table 5-3. Upon comparison of contaminant concentrations detected in wells TSF-05, TAN-25, and TAN-26, it is apparent that the 1992 RI, June 1993, and quarterly Interim Action results are generally consistent. However, it should be noted that contaminant concentrations detected during the Interim Action have varied depending on pumping rate.

6. SUMMARY OF SITE RISKS

A baseline risk assessment was conducted to evaluate the potential adverse health effects for both a current and future land use scenario to human and nonhuman receptors associated with exposure to chemical and radioactive substances detected in the TAN groundwater. The baseline risk assessment consists of a human health risk assessment and an ecological assessment.

6.1 Human Health Risk

6.1.1 Contaminants of Concern

In order to focus the risk assessment on COCs, the groundwater quality data collected during the RI were evaluated against analytical methods, quantitation limits, qualified and coded data, sample blank contamination, natural background elements, essential nutrients, and risk-based concentrations in a systematic manner according to guidance from both EPA and EPA Region 10.

The COCs and their concentration ranges for the groundwater sampled in the immediate vicinity of the TSF-05 Injection Well and the groundwater plume are listed in Table 5-1. The COCs list for the TAN groundwater plume include TCE, PCE, cis- and trans-1,2-DCE, Sr-90, and H-3. The same COCs were identified for the TSF-05 Injection Well with the addition of the radionuclides Cs-137 and U-234. Although U-234 and H-3 do not exceed the MCLs, these contaminants exceed the 10^{-6} risk-based concentration for groundwater ingestion. Tetrachloroethene was not detected above the detection limit of 500 μg/L in the TSF-05 Injection Well during 1992 sampling. However, it is considered a COC based on 1989 and 1993 data. The 1993 sampling showed PCE at a concentration of 20–22 μg/L in the TSF-05 Injection Well. Therefore, the final COC list includes TCE, PCE, cis-1,2-DCE, trans-1,2-DCE, H-3, Sr-90, U-234, and Cs-137 (see Table 5-1). Any additional contaminants detected during the OU 1-07B Remedial Action will be evaluated by the agencies for inclusion as COCs.

6.1.2 Exposure Assessment

The exposure assessment is used to estimate the type and magnitude of exposures to the COCs identified for the TAN groundwater and the TSF-05 Injection Well. The exposure assessment involves identifying potentially exposed populations and exposure pathways, estimating exposure concentrations (based on environmental monitoring data and fate and transport modeling), and estimating contaminant intakes for exposure pathways. The result of the exposure assessment estimates the pathway-specific intakes for both current and future exposures for the identified COCs. The potentially exposed populations identified for this risk assessment include site workers and future residents that may inhabit the site if DOE decides to relinquish control of the site.

Current access to the TAN groundwater is limited to production wells (TAN-1, TAN-2, ANP-8, FET-1, and FET-2), which bring the groundwater to the surface for drinking water and other uses such as lawn watering and industrial use. Untreated groundwater is not released to any natural

surface water body in the study area and is not available for direct uptake by plants or animals; therefore, these pathways are not evaluated in the current industrial use scenario. The current land use scenario evaluates the industrial use of groundwater from the production wells. Drinking water at TAN is obtained exclusively from bottled water or the TAN production well. Treatment using an air sparger before use reduces contaminant concentrations below Federal drinking water standards for the TAN production wells. However, for this risk assessment it was assumed that the air sparger was not present.

The future residential use scenario assumes three different time periods of institutional control. The assumed institutional control periods will last until the years 2024, 2040, or 2094 and are based on different expected lengths of time for programs at TAN to be operational, in addition to time to perform decontamination and decommissioning of the facilities in compliance with 10 CFR 61. The future residential use scenario consists of two different future land use cases. Case 1 is the use of the groundwater from the predicted average concentration for the contaminant plume. Case 2 considered the TSF-05 Injection Well as a potential future production well for residents. Although this is an unlikely scenario, it provides an upper bound for potential risks to residents should they be exposed to groundwater from this well. A summary of the TAN groundwater risk assessment exposure pathways is presented in Table 6-1.

Table 6-1. Test Area North groundwater exposure pathways.

Potentially exposed population	Exposure scenario	Potential exposure pathway
Current land use		
Industrial Workers	Use of untreated groundwater from production wells as potable water	Ingestion of water
	Use of untreated groundwater from production wells for showering	Inhalation of volatiles
Future land use		
Residential Case 1	Use of groundwater from predicted contaminant plume as potable water	Ingestion of water
	Use of groundwater from predicted contaminant plume for showering	Inhalation of volatiles
	Crops contaminated from irrigating with predicted contaminant plume groundwater	Consumption of crops
Residential Case 2	Use of groundwater from TSF-05 Injection Well as potable water	Ingestion of water
	Use of groundwater from TSF-05 Injection Well for showering	Inhalation of volatiles
	Crops contaminated from irrigating with TSF-05 Injection Well groundwater	Consumption of crops

Exposure scenarios evaluated in the risk assessment considered industrial and residential long-term (chronic) exposures for the following pathways: (a) ingestion of groundwater, (b) inhalation of volatiles while showering, and (c) ingestion of food crops (for residents only). Chronic exposures evaluated assume contaminant exposures to workers over a 25-year period and to residents living in the study area over a 30-year period. Industrial and residential reasonable maximum exposure factors were used in the risk assessment; a table of the reasonable maximum exposure factors used in the risk assessment can be found in Table 7-8 of the RI report.

6.1.3 Risk Characterization

Risk characterization integrates the results of the exposure assessment and the toxicity assessment in an estimate of risk to humans from the exposure to site contaminants. Noncarcinogenic effects are characterized by comparing projected intakes of substances to toxicity values. The carcinogenic effects or probability an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical-specific dose-response relationships. As discussed in the NCP, noncarcinogenic risk is compared to a hazard quotient (HQ) of one, with an HQ of less than one indicating it is unlikely even for sensitive subpopulations to experience adverse health effects. An HQ (the ratio of the level of exposure to an acceptable level) greater than 1.0 indicates that the exposure level may exceed the protective level for that particular chemical. If the HQs for individual chemicals are less than 1.0 but the sum of the HQs for all substances in an exposure medium (i.e., the hazard index) is greater than 1.0, there may be a concern for potential health effects. The acceptable risk range for carcinogenic risk, according to the NCP, is 10^{-4} to 10^{-6}. A cancer risk level of 1×10^{-4} (1 in 10,000) means that one additional person out of ten thousand is at risk of developing cancer if the site is not cleaned up.

The Integrated Risk Information System database and Health Effects Assessment Summary Tables provided the toxicity values used in the risk assessment for the COCs.

The carcinogenic risks from the potential exposure pathways evaluated for the current industrial use of groundwater from the TAN production wells are summarized in Table 6-2. The total carcinogenic risks from ingesting TAN groundwater range from 6×10^{-7} to 8×10^{-7}. The total carcinogenic risks from inhaling volatiles while showering is 4×10^{-8}. These results indicate the potential carcinogenic risk to the INEL workers from water pumped from the TAN production wells is less than the acceptable risk range of 10^{-4} to 10^{-6}. Table 6-2 also summarizes the chronic hazard index estimates for the potential exposure pathways evaluated for the organic COCs for the current industrial use of groundwater from the TAN production wells. The total hazard index for toxic effects from ingesting contaminated groundwater is 0.003. This value is less than 1.0, indicating it is unlikely workers will experience adverse health effects. Therefore, both carcinogenic and noncarcinogenic risk to industrial workers from TAN groundwater is minimal under the current industrial use scenario.

A summary of the cancer risk estimates for exposure to organic contaminants and radionuclides under the future residential use scenarios Case 1 and Case 2 are shown in Table 6-2. Total cancer risk estimates for exposure under the future residential use scenario Case 1 are all within or below the target risk range of 10^{-4} to 10^{-6}. Estimates of total cancer risk from the ingestion of contaminated groundwater under the future residential use scenario Case 2 are greater than the acceptable target risk range. The noncarcinogenic HQs for exposure under the future residential use scenarios Case 1 and Case 2 are shown in Table 6-2. The total HQs for exposure under future residential use Case 1 are all less than one. In Case 2, exposure to TSF-05 Injection Well water, the HQs for organic contaminants are above one.

Table 6-2. Summary of risk for Test Area North groundwater.

Scenario	Carcinogenic Risk[a]	Hazard Index[b]
Current industrial scenario (production wells)		
Organic chemical water ingestion	8 in 10,000,000 (8×10^{-7})	0.003
Radioactive water ingestion	6 in 10,000,000 (6×10^{-7})	NA[c]
Inhalation of volatiles	4 in 100,000,000 (4×10^{-8})	NA
Total risk	1 in 1,000,000 (1×10^{-6})	0.003
Future residential exposure to groundwater plume (Case 1)		
Organic chemical water ingestion	1 in 100,000 (1×10^{-5})	0.8
Radioactive water ingestion	4 in 1,000,000 (4×10^{-6})	NA
Inhalation of volatiles	7 in 10,000,000 (7×10^{-7})	NA
Organic chemical crop ingestion	3 in 1,000,000 (3×10^{-6})	0.1
Radioactive crop ingestion	1 in 100,000 (1×10^{-5})	NA
Total risk	3 in 100,000 (3×10^{-5})	0.9
Future residential exposure to TSF-05 groundwater (Case 2)		
Organic chemical water ingestion	1 in 1,000 (1×10^{-3})	20.5
Radioactive water ingestion	5 in 10,000 (5×10^{-4})	NA
Inhalation of volatiles	5 in 100,000 (5×10^{-5})	NA
Organic chemical crop ingestion	2 in 10,000 (2×10^{-4})	2.5
Radioactive crop ingestion	5 in 10,000 (5×10^{-4})	NA
Total risk	2 in 1,000 (2×10^{-3})	23

a. The NCP defines acceptable carcinogenic risk as <1 additional incidence of cancer in 10,000 to 1,000,000 or 10^{-4} to 10^{-6}.

b. A hazard index greater than 1.0 indicates that there may be concern for noncarcinogenic effects.

c. NA = not applicable.

In summary, the risk characterization indicates there is concern for potential health risks to future residents exposed to the contaminants found in groundwater pumped from the TSF-05 Injection Well and immediate vicinity. The primary risk driver is the ingestion of groundwater contaminated with TCE.

6.1.4 Uncertainty

Standard EPA methodologies in risk assessment were employed to evaluate the risk to human health from COCs in the groundwater at TAN. Risk assessment methodologies represent an inexact science, and a number of uncertainties are associated with their application. Factors contributing to uncertainty and limitations in the exposure assessment primarily relate to estimating contaminant concentrations in the study area, modeling groundwater contaminant fate and transport, estimating human exposure, and accounting for toxic effects from long-term exposure to these contaminants.

Uncertainty associated with sampling and analysis includes inherent variability in the analysis of samples, representativeness of samples, sampling error, and heterogeneity of the sample matrix. Sources of uncertainty in the contaminant fate and transport modeling include initial assumptions concerning the volume and concentration of the contaminant source, dispersivity and sorption coefficients, and aquifer physical parameters. A constant source for the contaminants based on 1992 measurements in the TSF-05 Injection Well was assumed for the fate and transport modeling. This assumption overestimates future contaminant concentrations, which results in upper bound or worst case risk estimates.

Estimates of exposure from contaminated media rely on assumptions that also contribute to the uncertainties associated with risk assessment. The current industrial exposure estimates are based on 25-year exposure to constant concentrations of contaminated water, at levels currently found in the TAN production wells. Because an air sparging system for treating the water has been installed at TAN, workers are not exposed to contaminated water. The future resident exposure estimates are based on a 30-year exposure to contaminated groundwater at constant concentrations. Because a constant source of contamination was assumed for the injection well, exposure estimates likely overestimate risks. The assumed exposure of future TAN residents to the existing high concentrations of contaminants found in the TSF-05 Injection Well (Case 2) results in an unacceptable risk according to the ranges listed in the NCP.

There are many uncertainties and unknowns associated with the toxic effects of the COCs for this risk assessment. They include extrapolation from high to low doses and from animals to humans; species differences in uptake, metabolism, organ distribution, and target site susceptibility; and human population variability with respect to diet, environment, activity patterns, and cultural factors.

6.2 Ecological Risk Assessment

The objective of the ecological risk assessment was to determine whether COCs found in the TAN groundwater result in an adverse ecological impact. The ecological assessment was a qualitative/ semiquantitative appraisal of the actual potential effects of the TAN groundwater on plants and animals (ecological receptors) other than people and domesticated animals. The scope of this study was limited to the TAN groundwater and the TSF-05 Injection Well as the sources of contamination, as identified in the human health assessment. Ecological risk will be reevaluated during the WAG-1 comprehensive RI/FS (OU 1-10), and a more detailed ecological risk assessment will be performed under the WAG 10 INEL Site-wide RI/FS.

6.2.1 Current Exposure

On the basis of the ecological risk assessment presented in the TAN groundwater RI report, pathways available for the exposure of ecological receptors are limited. Wells within the contaminated zone are used for sampling purposes, and when these wells were sampled, contaminated water was treated at the existing Interim Action treatment facility before disposal. Water from the TAN production wells is closely monitored for contaminants, and an air sparger system has been installed for the drinking water supply. Therefore, there is no current exposure of ecological receptors to the contaminated groundwater at TAN.

6.2.2 Future Exposure

Ecological receptors would be exposed primarily through irrigation of crops if TAN groundwater is used for this purpose in the future. Contaminants would be deposited on surfaces and soil, where they could be adsorbed onto plant surfaces, absorbed into the plant, or taken up from the soil through the roots. Herbivores could be exposed by ingesting plant material, soil, or water; dermal contact from contaminated plant surfaces and soil; and to a lesser degree, inhalation of resuspended contaminated particulates. Contaminants can be absorbed into the body after being inhaled or swallowed. Insectivorous animals would be similarly exposed by ingesting contaminated insects. Widely ranging herbivores, such as pronghorn antelope, elk, and sage grouse, could transport contaminants a considerable distance because of seasonal migrations. Carnivores could be exposed by ingesting contaminated water or prey, dermal contact, and inhalation. Top-level carnivores are important because they bioaccumulate contaminants by way of prey consumption, carrion consumption, or fecal consumption.

A simplified exposure scenario was evaluated in the risk assessment for an herbivorous rodent. As described above for ecological receptors, exposure would result from ingesting plant material, soil, or water from the use of contaminated groundwater for irrigation. In general, the calculations showed that the radiological doses in the future would be insignificant compared to background doses, except in the case of Sr-90. There is a possibility that Sr-90 could pose adverse effects. However, the nature of these effects cannot be fully evaluated at this level of analysis. Given the uncertainty in extrapolating data from laboratory studies to wild populations, it appears exposure to COCs would be sufficiently low, and no adverse effects would be expected in rodents occupying the irrigated cropland. Exposure to contaminants by higher level organisms (predators) would also be expected to be low. Additionally, contaminant intake by predators would likely be attenuated by ingestion of prey from outside the contaminated zone. The results of the ecological risk assessment indicate that risk to future ecological receptors would be low. In summary, no critical habitats are adversely affected by the TAN groundwater contamination and no endangered species or habitats of endangered species are adversely affected by the site contamination.

6.3 Impact of Interim Action Sampling Results on Risk Assessment

The fate and transport modeling and the risk assessment were based on the RI sampling results. As discussed in Section 5.3, contaminant concentrations are higher in wells TSF-05 and TAN-25 and lower in TAN-26 than assumed in the fate and transport modeling (Table 5-3). New fate and transport models were run to predict future plume concentrations using the new sampling data from the Interim Action. However, the specific carcinogenic risk and HQs for the COCs have not been calculated using the new data. While the higher contaminant concentrations could indicate risks to future receptors that are greater than previously estimated in the RI, the general conclusions of the risk assessment are still valid. Unacceptable risks would result from future residential use of contaminated groundwater from the vicinity of the TSF-05 Injection Well. Therefore, the new

information does not change the recommended remedial strategy for the OU 1-07B groundwater, which is discussed in the following sections of this ROD.

7. DESCRIPTION OF ALTERNATIVES

Eight alternatives were assembled and screened in the TAN groundwater OU 1-07B FS. Two alternatives were dropped from further consideration during the FS screening because these alternatives were estimated to require more than 150 years for remediation. Two other FS alternatives are not discussed in this ROD because they focus on containment of the hotspot, which is also covered under the two remaining and more comprehensive alternatives. Summary descriptions of the four remaining alternatives for reducing contamination in TAN groundwater are presented below.

In the year since the Proposed Plan was issued, new information has been developed concerning the fate and transport of trichloroethene in the groundwater. The estimated groundwater velocity of the trichloroethene plume is the same as that of the uncontaminated groundwater, which is approximately 1 ft/day. The Interim Action conducted under the 1-07A ROD confirmed that sludge could be removed from the TSF-05 Injection Well but did not confirm the extent of sludge present in the vicinity of the injection well. As a result, sludge or secondary source may be difficult or impractical to remove. The alternative descriptions summarized below are based on those presented in the May 1994 Proposed Plan with the following exceptions:

- The proposal to use surfactant has been removed because of the heterogeneity of the material disposed of in the TSF-05 Injection Well, the potential for mobilization of contaminants, and the potential noncontactability of the secondary source present within the hotspot.

- Recent modeling has shown that after removal of the greater than 5,000 μg/L TCE plume, approximately 200 years would be required for natural dispersion to reduce the remaining plume to concentrations below MCLs.

- The groundwater pumping rates estimated in the Proposed Plan are conservative by over one order of magnitude, thereby excessively inflating the costs for remediation.

- Recent groundwater monitoring data indicates that the greater than 5,000 μg/L TCE contamination is within 200 ft of TSF-05. Therefore, there is no need to follow the approach described in the May 1994 Proposed Plan for remediation of the hotspot and the greater than 5,000 μg/L TCE plume.

7.1 Alternative 1: No Action

The NCP requires a No Action alternative to establish a baseline for comparison to alternatives that require action. Under this alternative, no attempt would be made to contain, treat in place, or extract and treat any contaminated groundwater within OU 1-07B. No institutional controls are assumed and the Interim Action (OU 1-07A) would not be continued. Groundwater modeling indicates that, with no action, the contaminant plume for volatile organics would continue to spread and that the radiological plume would eventually shrink as a result of decay. Groundwater monitoring would be implemented under the No Action alternative to detect changes in OU 1-07B that may lead to situations that would be considered immediately dangerous to the public or environment. Any situation of this sort, detected through monitoring, would require mitigative measures to be taken to minimize risk to public health and the environment.

7.2 Alternative 2: Limited Action Consisting of Institutional Controls

Under this alternative, no action would be taken to remediate contaminated groundwater and contaminant sources associated with OU 1-07B. Instead, the Limited Action alternative would implement institutional controls to protect current and future users from health risks associated with the groundwater contamination. Groundwater modeling indicates that, with no action, the contaminant plume for VOCs would continue to spread and that the radiological plume would eventually shrink as a result of decay. Specific actions or controls could include groundwater monitoring, an alternative water supply, and/or access restrictions.

Groundwater monitoring would be conducted annually to monitor the distribution, migration, and fate of contaminants already in TAN groundwater. Groundwater monitoring would use the existing TAN groundwater monitoring wells for OU 1-07B, and analyses of groundwater samples would target the COCs. An alternative water supply well could be installed in an area that does not access the contaminated plume within the Snake River Plain Aquifer. The well would be capable of meeting the water supply needs of future residents at TAN after the institutional control period. Access restrictions would include land use notifications and fencing. Land use restrictions would include prohibiting the placement of wells within the contaminated plume and interfering with remedial activities. Fencing would enclose approximately 37 m^2 (400 ft^2) around the immediate vicinity of the existing TSF-05 Injection Well.

7.3 Alternative 3: 5,000 micrograms per liter Trichloroethene Groundwater Plume Extraction; Hotspot Containment and/or Removal with Aboveground Treatment

This alternative would involve (a) modification and operation of the existing extraction system and GWTF, (b) institutional controls and groundwater monitoring, (c) containment and/or removal with aboveground treatment of the highly contaminated groundwater and secondary source in the immediate vicinity of the TSF-05 Injection Well (the feasibility of hotspot remediation will be determined in a series of surge and stress tests), and (d) extraction and treatment of groundwater defined by the area of the aquifer with TCE concentrations greater than 5,000 μg/L.

This alternative would be performed in a phased approach. The existing extraction system and treatment facility would continue to be operated to support surge and stress of TSF-05 Injection Well to remove as much of the secondary source as practicable in conjunction with hydraulic containment of the hotspot. The initial phase of Alternative 3 would focus on secondary source removal through surge and stress. The second phase would include installation of wells for implementation of hotspot hydraulic containment. Surge and stress may continue to augment hydraulic containment and will be evaluated for effectiveness prior to implementation as a long-term remedy.

Hotspot containment would involve installing one or more pumping wells to contain contaminants within the 5,000 μg/L plume for extraction of groundwater. Extracted groundwater would be treated for VOCs aboveground and reinjected back into the aquifer within the capture zone of the extraction well(s). The process would function as a hydraulically contained system, capturing groundwater, treating to remove the organic contaminants, and then returning the groundwater back to the aquifer within the capture zone of the extraction well(s). Effective containment of the secondary source and capture of the reinjected groundwater may reduce contaminant migration beyond the capture zone. Hydraulic containment reduces further aquifer degradation, and ex situ VOC removal facilitates overall improvement of aquifer water quality.

Aboveground organic compound removal would be accomplished by air stripping, followed by carbon adsorption as necessary to remove volatilized organic compounds from vapor off-gas generated during the stripping process. The off-gas treatment system will reduce emissions of volatilized organic compounds to acceptable atmospheric levels in compliance with applicable or relevant and appropriate requirements (ARARs). Radionuclide concentrations will be reduced by an ion exchange or equivalent process to the extent practicable as determined by the agencies. After treatment, process effluent containing radionuclide (e.g., Sr-90, Cs-137) concentrations above MCLs may be reinjected into the upgradient portion of the hotspot. Because there is no treatment for tritium, process effluent containing tritium will be reinjected.

Carbon adsorption and ion exchange technologies are considered representative of available process treatment options. Other process influent/effluent treatment options (e.g., UV-oxidation, catalytic oxidation, etc.) were discussed in the Proposed Plan and will be considered as part of an engineering evaluation to be conducted prior to selection of the final remedial design. Because there is no treatment option for tritium, process effluent containing tritium will be reinjected.

The estimated costs given in the Proposed Plan are for a system operating at 1,000 gallons per minute (gpm) for 3 to 6 years at a cost of $25,800,000. Given the new information described above, the system costs based on a 30-year operation and maintenance (O&M) operating at less than 100 gpm is estimated at $23,657,000.

Under Alternative 3, no action other than Institutional Controls and Monitoring would be taken on the less than 5,000 μg/L component of the plume during implementation of the 1-07B remedial action. Instead, the site-wide RI/FS and subsequent ROD (OU 10-04) would include necessary remedial actions for that portion of the plume outside of the hydraulic containment area. If no remedial action were taken for the less than 5,000 μg/L plume, contaminated groundwater would continue to flow downgradient at an estimated rate of approximately 1 ft/day. Groundwater fate and transport modeling indicates aquifer dispersion would require approximately 200 years to reduce TCE contaminant levels to MCLs and the maximum extent of the plume would be approximately 15 miles south of TSF-05.

7.4 Alternative 4: 25 micrograms per liter Trichloroethene Groundwater Plume Extraction; Hotspot Containment and/or Removal With Aboveground Treatment

Alternative 4 involves remediation of contaminated groundwater with TCE concentrations greater than 25 μg/L, as well as remediation of the secondary source at the TSF-05 Injection Well. Thus, Alternative 4 includes remedial activity described under Alternative 3 with additional remediation of the groundwater plume defined by the area of the aquifer that contains TCE concentrations over 25 μg/L. Therefore, Alternative 4 would require additional treatment capacity over and above that proposed for Alternative 3. The remedial action described by Alternative 4 is designed to yield the maximum level of cleanup, and as such, corresponds to the largest volume of groundwater to be remediated.

Model simulations were performed in an effort to systematically determine the volume of TCE-contaminated groundwater requiring remediation. The simulation suggests that in order to achieve target MCLs or 10^{-4} to 10^{-6} risk-based concentrations for contaminants without established MCLs, the secondary source of contamination around the TSF-05 Injection Well and groundwater contained in the greater than 25 μg/L TCE plume would require remediation. Following remediation of the greater than 25 μg/L TCE plume, modeling suggests that the less than 25 μg/L TCE plume will

naturally degrade to MCLs within approximately 100 years. Revised groundwater modeling suggests that the treatment of the greater than 25 μg/L plume can be achieved at lower pumping rates than those assumed in the Proposed Plan.

Under Alternative 4, the hotspot would be contained and/or removed as described in Alternative 3 above and the less than 25 μg/L component of the plume would be allowed to undergo natural attenuation to acceptable concentration levels within an institutional control period of 100 years. Extraction and treatment of the dissolved phase groundwater plume would require a larger system than that proposed for Alternative 3. Extraction and treatment would be accomplished via three or more extraction wells and two or more injection wells. These wells would be located so as to intercept contaminated groundwater with concentrations greater than 25 μg/L, which is currently estimated to extend 1.5 miles downgradient of the TSF-05 Injection Well.

Leaching from the secondary source would be reduced by containment and/or source removal, and contaminants within the 25 to 5,000 μg/L TCE contaminated portion of the plume would be drawn into the downgradient capture zone for VOC treatment to concentrations below MCLs. The pumping rate needed to maintain the downgradient capture zone will be estimated based on site-specific modeling conducted during remedial design and may be adjusted based on field data after pumping begins. The cost estimate is based on the assumption that treatment of one pore volume (resulting in a 30 year O&M period) will be sufficient to remove TCE from the dissolved phase groundwater plume.

Aboveground treatment of the dissolved phase plume would be performed by air stripping with vapor off-gas treatment if necessary. It is not expected that liquid effluent resulting from dissolved phase plume remediation would require treatment to remove Sr-90, Cs-137, or U-234 due to radioactive decay and adsorption of these contaminants within the hotspot.

The estimated costs given in the Proposed Plan are for a system operating at 10,000 gpm for 10 to 40 years at a cost of $94,600,000. Given the new information described above, the system costs based on a 30-year O&M operating at less than 1,000 gpm is estimated at $29,888,000. The time period required to operate the hotspot containment and/or removal system is estimated to be the same as that for Alternative 3.

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The EPA has established nine criteria for the evaluation of remedial activities. The remedial alternatives were evaluated against the nine criteria, which are divided into three categories:

- Threshold criteria (describes a level of performance)
  - Overall protection of human health and the environment
  - Compliance with ARARs
- Balancing criteria (discusses technical advantages and disadvantages)
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost

- Modifying criteria (review and evaluation by other entities)
  - State acceptance
  - Community acceptance.

A summary of the comparative analysis of alternatives is presented in Table 8-1.

8.1 Threshold Criteria

8.1.1 Overall Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment because no action would be taken to address groundwater contamination and no controls would be implemented to prevent use of the groundwater. Alternative 2 would use institutional controls to protect human health and the environment until MCLs or 10^{-4} to 10^{-6} risk-based levels for contaminants without MCLs are achieved. Alternatives 3 and 4, combined with the use of institutional controls for those portions of the plume not under active remediation, are protective of human health and the environment.

Table 8-1. Comparative Analysis of Alternatives.

Alternatives Evaluation Criterion	Alternative #1: No Action	Alternative #2: Limited Action	Alternative #3: 5,000 μg/L TCE Plume	Alternative #4: 25 μg/L TCE Plume
Protection of human health and the environment	No[a]	Yes	Yes	Yes
Compliance with ARARs	NA[b]	No[a]	Yes[c]	Yes
Long-term effectiveness			+	++
Reduction of toxicity, mobility, or volume through treatment			+	++
Short-term effectiveness			+	++
Implementability			++	+
Cost			++	+
State acceptance			+	++
Community acceptance			+	+

a. Alternatives not meeting the threshold criteria were not evaluated further.

b. There is no ARAR analysis for the No Action alternative.

c. Assumes that additional remedial action will be taken in the INEL site-wide RI/FS.

\+ Effectively meets criterion.

++ More effectively meets criterion.

8.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

A detailed list of ARARs pertinent to OU 1-07B is provided in Section 10.2. The major ARAR is the Safe Drinking Water Act. For Alternative 1, No Action, there is no ARAR analysis. Alternative 2 would rely in part on natural processes to decrease contaminant concentrations in groundwater and drinking water standards would be exceeded beyond 100 years. Because Alternatives 1 and 2 do not satisfy the two threshold criteria, they will not be discussed further. Costs for Alternatives 1 and 2 are provided in Table 8-2.

New modeling data suggest that remediation defined by Alternative 3 would not achieve reduction of VOCs to meet drinking water standards in the less than 5,000 μg/L TCE component of the plume for approximately 200 years. It cannot be assumed that institutional controls would be maintained for this length of time. The reasonable timeframe for restoration of the aquifer to drinking water standards should not exceed 100 years, which is in keeping with current land use assumptions for INEL. At the time of the Proposed Plan, it was believed that Alternative 3 would meet the 100-year remedial action objective (RAO). However, recent groundwater modeling has shown that after removal of the greater than 5,000 μg/L plume, approximately 200 years would be required for natural dispersion to reduce the remaining plume to concentrations below MCLs. Due to the 200 years required, Alternative 3 could only be implemented if further remediation of the less than 5,000 μg/L TCE part of the plume were included in the site-wide RI/FS. If additional remedial action is taken to reduce the restoration timeframe to 100 years or less, Alternative 3 would be in compliance with ARARs. Alternative 4 would treat the 25 to 5,000 μg/L TCE contaminated groundwater to levels such that drinking water standards would be met within 100 years. For either Alternative 3 or 4, the hotspot would need to be removed or contained to prevent continued leaching of the TCE contaminated secondary source. See Table 10-1 for summary of ARARs that apply to Alternative 3 and Alternative 4.

8.2 Primary Balancing Criteria

After evaluation of each alternative under the two threshold criteria, five balancing criteria are used to evaluate other aspects of the potential remedial alternatives. Alternatives 3 and 4 were evaluated using each balancing criterion. The balancing criteria were used in refining the selection of the remedial alternative.

8.2.1 Long-Term Effectiveness and Permanence

Alternative 3 would have good long-term effectiveness and permanence for the hotspot. When combined with institutional controls, and assuming that additional remedial actions are taken to restore the aquifer to below MCLs within 100 years, this alternative will be effective at preventing exposure to unacceptable levels of contamination. Alternative 4 would have the best long-term effectiveness and permanence because it is less dependent upon institutional controls and future undetermined remedial actions.

8.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

Both Alternatives 3 and 4 would collect and treat COCs in the hotspot region, resulting in a volume and mobility reduction of TCE and other contaminants. Alternative 4 would address a much larger volume of contaminated groundwater than Alternative 3 and would prevent migration of a major component of the plume into previously uncontaminated groundwater.

Table 8-2. Estimated costs associated with remediation alternatives (present worth).

Cost element	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Construction	0	128,000	707,000	3,279,000
Operations[a]	0	0	6,507,000	7,818,000
Waste handling	0	0	1,323,000	1,323,000
Treatability[b]	0	0	2,470,000	2,470,000
Monitoring[c]	2,688,000	2,688,000	1,971,000	1,971,000
Indirects	403,000	403,000	6,727,000	8,034,000
Contingency	597,000	621,000	3,952,000	4,993,000
Total[d]	**3,688,000**	**3,840,000**	**23,657,000**	**29,888,000**

a. The operations costs are based on a 30-year period of performance for remedial activity.

b. Treatability studies will be required for the contaminant recovery technologies being considered for remediation of the TSF-05 Injection Well hotspot and the 25 to 5,000 μg/L dissolved phase plume. It is expected that the hotspot remediation will be the same regardless of whether it comes under Alternative 3 or Alternative 4.

c. Monitoring costs for Alternatives 1 and 2 are based on a 100-year institutional control period. Monitoring costs for Alternatives 3 and 4 are based on a 30-year remediation period.

d. The total costs are in present worth dollars at a 5% discount rate and are expected to be within -30 to +50% of the actual remediation costs. This is consistent with EPA guidelines for conceptual level cost estimating under CERCLA.

8.2.3 Short-Term Effectiveness

Alternatives 3 and 4 would not be expected to pose an unacceptable risk to workers or visitors during implementation. Appropriate air pollution control equipment would be used as necessary to ensure that air emissions do not pose an unacceptable human health risk. All potential impacts from construction and system operations will be readily controlled using standard engineering controls and practices. Alternative 4 is expected to achieve a greater degree of aquifer restoration in a shorter timeframe than Alternative 3 based on capture and treatment of TCE contaminated groundwater in the greater than 25 μg/L dissolved phase plume.

8.2.4 Implementability

Alternatives 3 and 4 require a phased approach to verify treatment performance and determine sizing criteria for the remedial design.

Alternative 4 would require a greater number of wells, additional treatment capacity, and disposal of a larger volume of residual waste, thus Alternative 4 has more technical and administrative difficulties than Alternative 3.

8.2.5 Cost

A summary comparison of estimated costs for the four remediation alternatives is presented in Table 8-2 and a detailed summary of estimated costs for the selected alternative are presented in Table 8-3. These costs differ from those presented in the May 1994 Proposed Plan based on the new information identified in Section 7. The full costs for Alternative 3 are not known because the less than 5,000 μg/L TCE component of the plume would not be addressed until the site-wide RI/FS is written. During implementation of the 1-07B remedial action specified under Alternative 3, no action other than institutional controls and monitoring would be taken on the less than 5,000 μg/L component of the plume. Instead, the site-wide RI/FS and subsequent ROD (OU 10-04) would include necessary remedial actions for that portion of the plume outside of the hydraulic containment area.

The estimated $25,800,000 cost for Alternative 3 given in the Proposed Plan is for a treatment system operating at 1,000 gpm for 3 to 6 years. Given the new information described above, secondary source containment and/or removal is expected to be achieved with a treatment system operating at 100 gpm over a 30-year O&M period with an estimated cost of $23,657,000.

Table 8-3. Cost summary for the OU 1-07B selected alternative.

Activity	Construction ($)	Operations and maintenance ($)	Waste handling and disposal ($)	Indirects ($)	Contingency[a] ($)	Subtotal ($)
Phase A						
Remedial Design (RD)/ Remedial Action Scope and ROD revisions	NA	NA	NA	450,000	50,000	500,000
Phase B						
Continuing operation of GWTF	707,000	2,037,000	651,000	1,876,000	1,054,000	6,325,000
Treatability studies/support activities	NA	283,000	NA	1,588,000	929,000	2,800,000
Bench-scale testing	NA	694,000	NA	NA	NA	694,000
Pilot-scale testing	785,000	991,000	56,000	NA	NA	1,832,000
Phase C						
Final remediation technology						
Implementation and operation	2,572,000	5,498,000	616,000	4,120,000	2,960,000	15,766,000
Monitoring						
Monitoring		1,971,000				1,971,000
Total present value cost	**4,064,000**	**11,474,000**	**1,323,000**	**8,034,000**	**4,993,000**	**29,888,000**

a. Agency notification will be required prior to allocation of contingency, should funds in excess of 90% of the amounts specified for construction, operations, waste handling, or indirects be required to complete the activity.

The estimated $94,600,000 cost for Alternative 4 given in the Proposed Plan is for a treatment system operating at 10,000 gpm for 10 to 40 years. Given the new information presented in Section 7.4 above, secondary source containment and/or removal, and dissolved phase groundwater treatment system operating at 1,000 gpm or less over a 30-year O&M period is estimated at $29,888,000.

8.3 Modifying Criteria

8.3.1 State Acceptance

This assessment criterion evaluates the technical and administrative issues and concerns that the IDHW may have regarding each alternative. The IDHW has been involved with the development and review of the proposed plan, ROD, and other project activities such as public meetings. The IDHW concurs with the selected remedy as discussed in Section 9.

8.3.2 Community Acceptance

The community acceptance criterion evaluates issues and concerns the public may have regarding each alternative described in the proposed plan and in the RI/FS. On the basis of verbal comments received during the public meetings held on June 6, 8, and 9, 1994, and written comments received during the comment period ending June 18, 1994, the community appears to accept the preferred remedial alternative. Specific responses and comments on the remedial alternatives can be found in the Responsiveness Summary appended to this document.

9. SELECTED REMEDY

9.1 Major Components of the Selected Remedy

After reviewing recent information provided by groundwater capture and treatment simulations and subsequently evaluating Alternatives 1 through 4 against the nine specific CERCLA criteria, the selected remedial action for OU 1-07B is Alternative 4: 25 micrograms per liter Trichloroethene Groundwater Plume Extraction; Hotspot Containment and/or Removal with Aboveground Treatment. Alternatives 1 and 2 were eliminated because they did not satisfy the threshold criteria. Alternative 3, the preferred alternative identified in the Proposed Plan, requires a commitment to perform necessary remedial actions on the less than 5,000 μg/L plume in a subsequent RI/FS. Also, in comparing Alternatives 3 and 4 in light of the new information, Alternative 4 better satisfies the CERCLA evaluation criteria (Section 8). Groundwater modeling calculations show that containment and/or removal of the hotspot with subsequent treatment of the 25 to 5,000 μg/L component of the plume, would greatly reduce the extent of aquifer contamination and would reduce the time for restoration of the dissolved phase plume to drinking water standards. The operations and maintenance cost to implement Alternative 4 would be greater than Alternative 3, but the restoration timeframe would be accelerated.

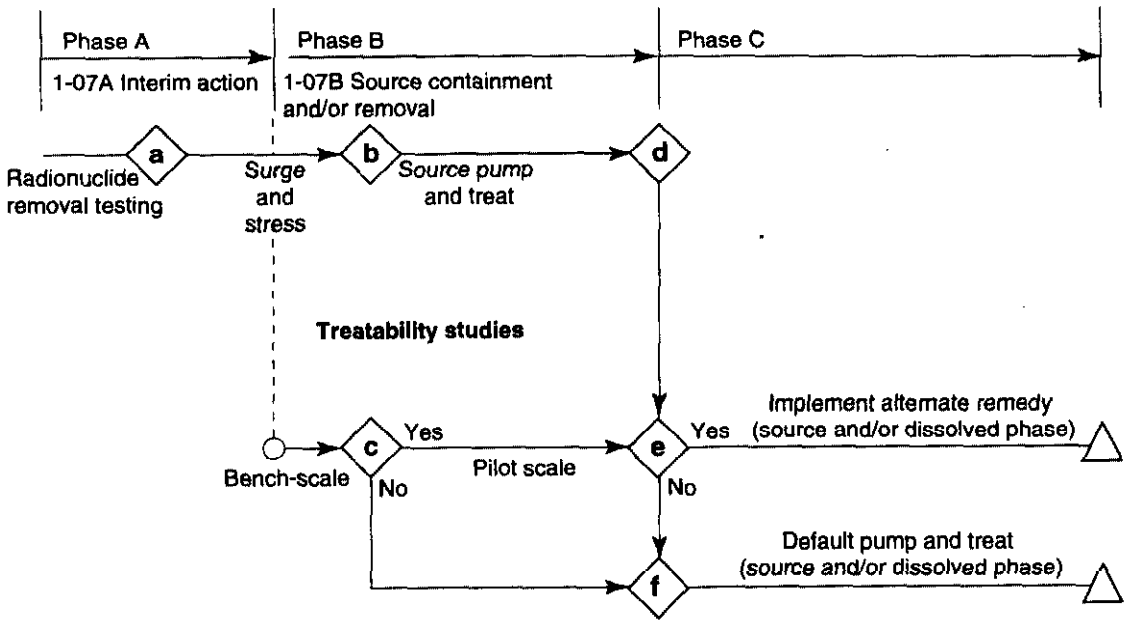
Alternative 4 is planned to be conducted in three phases: Phase A will be completed in 1996 and serves as a transition from 1-07A to 1-07B activities. Phase B focuses on hydraulic containment and source removal via surge and stress from 1996 to 1998 (3-year duration). Phase B also includes Treatability studies to evaluate innovative technologies against the selected alternative. Bench-scale treatability studies will be conducted during 1996 and following evaluation of bench-scale results, pilot scale studies will be conducted during 1997 and 1998. Evaluation of emerging technologies and routine groundwater monitoring will be conducted concurrent with these activities. For cost

estimating purposes, Phase C is assumed to be conducted from 1999 through 2025 (27 year duration). Phase C implements the long-term final remedial action, is expected to be completed in no more than 100 years, and will end when the NCP review process demonstrates that RAOs have been met.

Figure 9-1 is a schematic of the estimated sequence of activities for completion of the final remedial action. Alternative 4 is believed to provide a good balance of the evaluation criteria among the alternatives considered. The agencies determined that the preferred alternative will be protective of human health and the environment, will comply with applicable Federal and State regulations, and will be cost effective.

9.1.1 Need for Treatability Studies

During the year following issuance of the Proposed Plan, groundwater monitoring data and refined fate and transport simulations have suggested that initial estimates for remedial action were overly conservative (e.g., groundwater pumping rates and size of associated treatment facilities). Further, new technologies have advanced that show great potential for treating the organic contamination in situ or reducing the toxicity of contaminants aboveground.



a) At completion of Phase A testing set radionuclide discharge limits for reinjection of process effluent during Phase B and C.

b) Evaluate Surge and Stress 15 months after ROD signature to determine if secondary source removal is effective. Continue if effective, discontinue if not effective.

c) Evaluate Treatability Study bench scale results to select technologies for pilot scale studies.

d) Evaluate effectiveness of source hydraulic containment and/or removal.

e) Evaluate Treatability Study pilot scale results against default pump and treat to select and implement the most effective final remedial action process. The selection may require ROD revision and further public review and comment.

f) No technologies shown to be more effective than default pump and treat. Implement Alternative 4.

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Figure 9-1. Schematic of the estimated sequence for OU 1-07B.

The selected remedy of groundwater pumping, aboveground treatment (air stripping and off-gas treatment, or equivalent technology as necessary) and reinjection of treated groundwater should be effective in restoring much, if not all, of the aquifer to drinking water quality within 100 years. It may also be possible to reduce the overall remedial timeframe as well as capital and/or operating costs of the selected remedy through the use of innovative and new technologies. To provide an opportunity to evaluate the most promising new and innovative technologies, a phased approach will be implemented.

9.1.2 Description of Selected Remedy

Alternative 4 will be implemented in three phases:

Phase A—Transition of 1-07A Interim Action to 1-07B Final Remedial Action

Phase B—Hotspot Containment and/or Removal with Treatability Studies

Phase C—Dissolved Phase Groundwater Treatment with Continuation of Hotspot Containment and/or Removal.

The overall approach for each of the three phases is summarized below:

9.1.2.1 Phase A—Transition of OU 1-07A Interim Action to OU 1-07B Final Remedial Action. The OU 1-07A surge and stress pumping of the TSF-05 Injection Well will continue. This action will be done to remove secondary source material, pump and treat contaminated groundwater in the vicinity of TSF-05, and collect data on aquifer parameters to establish the potential for continued pumping of the hotspot for removal of the secondary source of TCE contamination. The transition may include installation of wells to support remedial activities. Phase A is directly associated with the OU 1-07A ROD, which will end with the signing of the OU 1-07B ROD. However, the OU 1-07A activity will be incorporated into OU 1-07B Phase B activities, as necessary, to meet the objectives of the OU 1-07B ROD.

Phase A will include operation of the existing GWTF to limit the migration of contaminants from the hotspot until Phase B is initiated. Activities associated with this task include (a) performing tests on filters, selected resins and other media (e.g., zeolites) to determine the practicability and cost-effectiveness of radionuclide removal from extracted groundwater; and (b) surging and stressing the TSF-05 well to remove as much secondary source as possible from the vicinity of the borehole and increase well efficiency.

The existing GWTF will be used to process groundwater extracted from within the greater than 5,000 μg/L TCE contaminated plume. Treated water will be reinjected within the extraction well capture zone, thus creating a hydraulically contained system of extraction, treatment, and reinjection. Hydraulic containment will enhance removal of contaminants in the vicinity of the well bore.

Prior to the agency decision on radionuclide performance standards, the GWTF will operate using the existing treatment system. Following a single pass through the treatment train, the effluent will be reinjected to the aquifer and may contain contaminants that exceed MCLs.

On the basis of current data, surging and stressing TSF-05 Injection Well will result in high organic and radionuclide influent concentrations. The extraction/treatment system will be operated and/or modified to reduce effluent concentrations of volatile organic contaminants below MCLs.

Volatile organic compounds discharged to the atmosphere from GWTF operations will not exceed the calculated emission rate limits specified in Table 9-1. Radionuclide concentrations will be reduced by an ion exchange or equivalent process to the extent practicable as determined by the agencies. On the basis of a review of the Radionuclide Removal Studies Report (Phase A, activity "a") and a cost benefit analysis of the selected treatment system, the agencies will determine radionuclide reinjection performance standards. After treatment, Sr-90, Cs-137 and/or other radionuclides at concentrations above MCLs may be reinjected into the upgradient portion of the hotspot.

9.1.2.2 Phase B—Hotspot Containment and/or Removal and Treatability Studies. Hotspot containment and/or removal will involve implementing groundwater extraction in the hotspot area at a rate sufficient to create hydraulic containment of TCE and other contaminants within the greater than 5,000 μg/L plume. Surge and stress will continue during Phase B. Surge and stress data will be evaluated to determine whether the process is successful for removal of secondary source material. Treatability bench- and pilot-scale studies for promising remediation technologies will run concurrent with hotspot containment and/or removal over a 3-year period. At the end of this period, the treatability study results will be evaluated against the long-term remedy described below as Phase C.

Phase B can be considered an enhancement of the OU 1-07A Interim Action. Additional wells may be installed, as necessary, and will be operated within the greater than 5,000 μg/L TCE plume at a rate sufficient to create hydraulic containment and prevent contaminant migration. Preliminary modeling suggests containment may be achieved with a 50 gpm pump rate; however, specific pumping rates, well depths, number of wells and well locations will be determined in the remedial design. Implementation of extraction, aboveground treatment, followed by reinjection will initiate hydraulic containment within 15 months of the signing of this ROD.

Table 9-1. Idaho Administrative Procedures Act (IDAPA) emission rate screening levels, air concentration screening levels, and calculated emission rate limits for OU 1-07B.

Contaminants of concern	IDAPA emission rate screening level (lb/hr)[a,b]	Air concentration screening level increments ($\mu g/m^3$)	Calculated emission rate limit (lb/hr)
TCE	0.00051	0.077[c]	0.185
PCE	0.013	2.1[c]	5.05
DCE	52.7	39,500[d]	1,254

a. Emission screening levels for TCE, PCE, total 1,2,DCE are derived from IDAPA 16.01.01.585 and 16.01.01.586—Toxic Air Pollutants Noncarcinogenic and Carcinogenic Increments apply to operation of the GWTF.

b. Air emission for organics will comply with the 95% removal or 3 lb/hr requirement of IDAPA 16.01.05.008 (40 CFR 264 Subpart AA).

c. Emission rate limits based on annual averages.

d. Emission rate limit based on 24 hr average.

The contaminated groundwater will be treated using basically the same treatment system designed for OU 1-07A. The system will consist of a multimedia filter and/or separator for nonaqueous phase liquids and suspended solids and an air stripper with air pollution controls as necessary (e.g., activated carbon or equivalent off-gas treatment technology). The air stripper will be operated in compliance with State and Federal air and hazardous waste management requirements. A treatment system (e.g., ion exchange columns) will be used, as practicable, to reduce radionuclide concentrations to performance standards established by the agencies.

On the basis of a review of the Radionuclide Removal Studies Report (Phase A, activity "a") and a cost benefit analysis of the selected treatment system, the agencies will determine radionuclide reinjection performance standards. Should the radionuclide testing prove ineffective at reducing radionuclide concentrations, process effluent containing radionuclides (e.g., Sr-90, Cs-137) above MCLs will be reinjected into the aquifer within the hydraulic containment zone to enhance flushing of contaminants within the hotspot. Although contaminant concentrations in reinjected groundwater may exceed drinking water standards, the selected remedy employs an extraction, treatment, and reinjection process that substantially improves aquifer water quality. Furthermore, institutional controls will ensure that contamination will not endanger present or future beneficial use.

Storage of hazardous or mixed waste generated from groundwater treatment constitutes permissible storage for the purpose of accumulating sufficient quantities to facilitate treatment and disposal. In the event that hazardous or mixed waste treatment residues are removed from storage for treatment/disposal at the INEL, LDR compliance may be addressed through the INEL Federal Facility Compliance Act Site Treatment Plan and Consent Order. If hazardous or mixed waste (activated carbon, sediments, or spent resins) generated by groundwater treatment is transported off the INEL, subsequent management will comply with EPA's "Off-Site Rule" (40 CFR 300.440). All purge water and unused and unaltered sample residue returned from analytical laboratories will be treated at a minimum to remove VOCs and reinjected. Characterization using analytical results and/or process knowledge/history will be performed on all treatment plant waste residuals to determine compliance with State and Federal hazardous waste management requirements. Periodic monitoring of the treatment system influent contaminated groundwater for selected organic and inorganic COCs, and effluent air and water from the air stripper and ion exchange column will be conducted at a rate to be determined by the agencies.

Treatability Study Evaluation—Phase B includes several two-stage treatability studies to determine whether a new and innovative technology may be more effective than the selected remedy. The first stage will be bench-scale evaluations. The second stage or pilot-scale testing will be conducted if the bench-scale testing indicates the technology has potential for remediating TAN groundwater more effectively than the selected alternative. A Treatability Study Work Plan will describe the specific studies to be performed, schedule for implementation, and reporting format. The Treatability Study Work Plan shall include a conceptual design and cost estimate for each of the technologies evaluated. As an ongoing effort, the agencies have evaluated a number of innovative and emerging technologies. The results of this evaluation are contained in a technical report entitled, *Technical Memorandum for Waste Area Group 1, Operable Unit 1-07B, Alternatives Evaluation (Draft)*, which is contained in the administrative record. The remedies identified as having the potential for reducing overall remediation timeframe and/or the potential for being more effective than the selected alternative are

- In situ bioremediation of the hotspot and the 25 to 5,000 μg/L portion of the plume
- Reductive iron dechlorination

- In situ chemical oxidation of the hotspot
- Natural attenuation
- Monolithic confinement (grout curtain).

The timeframe for completion of the studies and submittal of the Treatability Study Report is 36 months from the signing of this ROD. The pilot-scale studies will lead to a comparison of each technology against the two threshold criteria and five balancing criteria established in the NCP to determine whether any technology is more effective than the selected alternative.

The new and innovative technologies that will be evaluated in treatability studies, are described below.

In Situ Bioremediation—In situ bioremediation is an innovative technology for destroying chlorinated contaminants dissolved in groundwater. Pilot-scale field tests of in situ bioremediation at other sites around the country have demonstrated promising results in recent years. Through this process, chlorinated contaminants are transformed by biological processes to lower toxicity end products. Generally, the microorganisms responsible for the transformations do not directly feed on the contaminant, but rather the transformations are brought about by cometabolic degradation. Cometabolic degradation involves interactions of the contaminants with enzymes produced by the microorganisms for other purposes. To achieve cometabolic degradation, other chemicals must be present to serve as nutrient sources for the microorganisms.

The benefit of in situ bioremediation is that VOCs are treated in the aquifer, thereby lessening or eliminating the need for conventional air strippers and air pollution control devices, and their associated long term maintenance costs. Although extraction wells are used, the extracted water is recycled and reinjected in separate wells as a component of the treatment systems.

Treatability testing is necessary to determine the effectiveness of active bioremediation under site conditions. Bench-scale testing is needed to characterize the presence of indigenous microorganisms that can transform TCE, select nutrients and optimize nutrient concentrations, determine a range of TCE concentrations over which bioremediation is most effective, and evaluate any intermediate compounds that may be formed during bioremediation of TCE. If the bench-scale tests yield promising results, pilot-scale testing will be required to determine and optimize nutrient delivery systems (e.g., well configurations and pumping rates).

Full-scale implementation may involve development of an in situ bio-barrier transverse to the direction of groundwater flow. The bio-barrier would be created by installing a series of injection and extraction wells in an offset pattern across the plume. It is estimated that two injection wells and three extraction wells may be needed to effectively capture the width of the plume. The optimal location of the bio-barrier and recommended pumping rates, would be determined through the treatability study. An alternative to the bio-barrier concept may involve creating biologically active areas within selected areas of contamination using extraction wells to draw contaminated groundwater through these reactive zones. The treatability study will evaluate the most effective design of an in situ bioremediation system for both the hotspot and the 25 to 5,000 μg/L portion of the plume.

Reductive Iron Dechlorination—Current studies indicate that zero-valent iron is highly effective in enhancing the rate of degradation of a wide range of chlorinated aliphatic compounds in aqueous solution. Because zero-valent iron is readily available at low cost and bench tests have proven its effectiveness, it is a good choice to degrade chlorinated aliphatic compounds such as the

VOC COCs in the groundwater at TAN. Additionally, studies indicate that while degradation products are created by this process, they are also destroyed given adequate retention time. Also, laboratory tests indicate that this technology effectively reduces effluent contaminant concentrations below analytical detection limits.

Radionuclides that are found in TAN groundwater are not expected to react with the iron filings. However, the strontium is expected to follow calcium in the water and if calcium precipitates, the strontium will remain with the calcium carbonate. This process and its potential to produce a secondary waste stream will be evaluated during the Treatability Study.

In Situ Chemical Oxidation—In situ chemical oxidation is an experimental technology for degrading chlorinated solvents in groundwater. Laboratory tests and small-scale experiments have shown that the oxidant potassium permanganate is effective in degrading TCE and PCE to less toxic end products such as carbon dioxide, chlorine, chloride, and total manganese. This technology has promising potential for remediating source areas, where concentrations of TCE are highest and undissolved solvent may exist.

The potassium permanganate is injected into the aquifer and the oxidation reaction occurs in situ. Therefore the complexity of the required aboveground treatment components is greatly reduced compared with conventional pump and treat systems. The treatment process functions in a hydraulically contained system. Oxidant is injected into the source area and the treated groundwater is extracted at a downgradient well. The recovered water is tested for oxidation products and remaining solvent, augmented with more oxidant if needed, and then reinjected into the source area. A bench-scale study to evaluate this technology under site conditions would be conducted followed by a pilot field-scale demonstration to optimize remedial design.

Natural Attenuation—The effect of natural contaminant degradation processes may augment simple aquifer dispersion during natural attenuation of groundwater contaminants. However, site-specific information is lacking on the potential for biotic degradation, abiotic degradation or other natural attenuation processes that may affect the TCE contaminated plume. A Treatability Study will be performed to evaluate the rate and extent of natural TCE degradation. This will involve collection and evaluation of available information on natural processes followed by a site-specific field test to determine degradation trends based on time and distance downgradient from the secondary source. The Treatability Study will evaluate degradation of TCE and all derivative products generated during natural degradation processes. The results of this study will be used to refine fate and transport simulation estimates of aquifer restoration timeframe and to assist in design of Phase C remedial action.

Monolithic Confinement—The use of grout as a physical barrier to groundwater flow is a well established process. The determination of necessary well spacing and grout quantity will be evaluated under the Treatability Study. If the above treatability studies do not show promise, and the estimated timeframe for continued pumping and aboveground treatment appears indefinite, cost-effectiveness of this option versus long-term pumping and aboveground treatment will be evaluated.

9.1.2.3 Phase C—Dissolved Phase Groundwater Treatment with Continuation of Hotspot Containment and/or Removal. Dissolved phase groundwater treatment will involve the design of extraction wells, treatment systems, and reinjection wells approximately 3 years after signature of this ROD. Phase C remedial activity will be designed to capture the 25 to 5,000 μg/L portion of the plume, treat via air stripping, and reinject treated groundwater to enhance natural attenuation in the less than 25 μg/L plume. Hydraulic containment and/or removal initiated during Phase B at the

hotspot will continue throughout Phase C. The Phase C pump and treat technology may be replaced by an innovative technology (described in Section 9.1.3) should the treatability studies indicate a viable replacement alternative.

Phase C begins on completion of the treatability studies and involves the installation of extraction and injection wells so spaced as to intercept the greater than 25 μg/L TCE contaminated plume. Specific pumping rates, well depths, number of wells and well locations will be determined in the remedial design. Aboveground treatment will be similar to that described for Phase B (air stripping/sparging with off-gas treatment as necessary). Actual treatment system components will be determined as a part of remedial design. However, in consideration of approximate well locations within the dissolved phase plume, it is anticipated that the air stripping efficiency and need for air pollution control will be minimal to achieve groundwater volatile organic contaminant treatment to less than MCLs. There is no anticipated need for a radionuclide treatment system because radionuclides are detected only in the vicinity of the hotspot and have not migrated downgradient. However, based on monitoring data, agency review of the Radionuclide Removal Study Report, and determination of radionuclide reinjection performance standards, the design may consider installation of such equipment as a contingency. Periodic monitoring of the treatment system influent contaminated groundwater for selected organic and inorganic COCs, and of effluent air and water emissions from the air stripper will be conducted at a rate to be determined by the agencies. Phase C design will be initiated within six months of completion of the Treatability Study described in Phase B.

9.1.2.4 Institutional Controls and Groundwater Monitoring—Institutional controls will consist of engineering and administrative controls to protect current and future users from health risks associated with groundwater contamination by preventing ingestion of groundwater having contaminant concentrations of COCs exceeding MCLs or 10^{-4} to 10^{-6} risk-based concentrations for contaminants without MCLs. Administrative controls shall include placing written notification of this remedial action in the facility land use master plan; the notification shall prohibit (1) installation of any wells accessing the aquifer within the contaminated plume, and (2) engaging in any activities that would interfere with the remedial activity. A copy of the notification shall be given to the Bureau of Land Management (BLM), together with a request that a similar notification be placed in the BLM's property management records for this site. U.S. Department of Energy shall provide EPA and the State with written verification that notifications, including BLM notification, have been fully implemented.

Access to this portion of the contaminant plume will be institutionally controlled until MCLs or 10^{-4} to 10^{-6} risk-based concentrations for contaminants without MCLs are achieved. Groundwater monitoring will be performed in accordance with monitoring plans developed as part of the Remedial Design/Remedial Action. The plans will consider RAOs and monitoring data will be used to track the greater than 5 μg/L TCE plume, document COC concentration changes over time, provide information on the attenuation rate of the plume, to evaluate attainment of RAOs. Additional details on institutional controls are provided in Section 7.2. Concentrations will be contoured on the basis of the most recent data and additional samples may be collected, as necessary to establish a baseline of contaminant concentrations prior to active remediation.

9.1.3 Selection of an Alternate Remedy to Potentially Replace Conventional Pump and Treat

In the event that one or more of the treatability studies are shown to reduce the overall remedial timeframe or significantly reduce overall cost, the technology may be proposed as a replacement for the base-case described as Phase C. If a technology is found to be more effective than continued

long-term implementation of Phase C, the agencies shall, after appropriate public opportunity to review the basis for changing the selected technology, modify this ROD as appropriate and begin design implementation on the alternate remedy. This determination will be based on the information provided in the Treatability Study Report, which will include a conceptual design and cost estimate for each of the technologies evaluated as well as a comparison of each technology against the two threshold criteria and five balancing criteria established in the NCP. However, in the event that an innovative technology is selected to replace the Alternative 4 Phase C remedy, the Phase B remedy shall continue to operate until such time as the innovative remedial action is operational and functional.

9.1.4 Agency Evaluation and Review of the Selected Remedy

The agencies will evaluate, at a minimum, and document the effectiveness of the selected remedy within 5 years and every 5 years thereafter through the standard CERCLA 5-year review process. This review does not preclude more frequent review by one or more of the agencies. Specifically, the agencies will use, but will not be limited to the following evaluation criteria in the reviews:

- Determine whether the portion of the groundwater plume having TCE concentrations greater than 5,000 μg/L is effectively being contained, based on sampling results.

- Determine whether the greater than 25 μg/L portion of the groundwater TCE plume is attenuating as modeled if containment is effective.

- Determine whether the groundwater restoration assumptions are still valid. These are, but are not limited to the assumption that TCE is the major constituent defining the contaminant plume, land use is such that institutional controls are maintained throughout the restoration period whether or not DOE maintains ownership of the property. It is estimated that institutional controls will need to be maintained and monitored for 100 years.

- Evaluate and use groundwater quality data and groundwater level measurements routinely to determine treatment effectiveness and to provide indications of potential problems regarding groundwater treatment.

On the basis of the evaluation performed during the review, a decision will be made by the agencies to continue or discontinue the OU 1-07B remedial action. Similar evaluations will be performed for subsequent 5-year reviews. Other factors that will be taken into consideration during the reviews include, but are not limited to

- Acceptability of the residual risk levels achieved

- Cost of continuing the action in comparison to incremental risk reduction expected

- Changes in future land use or changes in the EPA groundwater protection strategy

- Technical practicability of restoring the aquifer (e.g., ability to contain the portion of the plume having TCE concentrations greater than 5,000 μg/L, modifications that could expedite the cleanup in a cost effective manner).

9.2 Remedial Action Objectives

As part of the RI/FS process, RAOs were developed in accordance with the NCP and EPA guidance for conducting RI/FS investigations. The purpose of the objectives is to reduce the contamination in the groundwater at TAN to ensure that offsite populations are not at risk in the future and that the future residents would not be at risk from use of TAN groundwater if the TAN area were converted to the public domain at any time in the future. Remedial action objectives for the selected alternative are

- Phase A—Remove as much of the secondary source as possible from the vicinity of the TSF-05 Injection Well by physically and hydraulically stressing the well. The treatment system shall be designed such that concentrations of VOCs in the effluent are below MCLs before reinjection into the hotspot. All attempts will be made to operate this process as a hydraulically contained system. The air pollution control device will be operated in compliance with ARARs. Continue surging and stressing the well for 15 months unless Phase B is ready to begin before this date.

- Phase B—Prevent, to the maximum extent practicable, migration of contaminated groundwater beyond the hotspot at levels above MCLs, or for those contaminants for which an MCL does not exist, the contaminant concentration will be such that the total excess cancer risk posed by release of contaminated groundwater will be within the acceptable range of 10^{-4} to 10^{-6}. For aboveground treatment processes using reinjection of treated effluent, treatment shall, at a minimum, be sufficient to reduce the VOC concentration to below MCLs. Volatile organic compounds discharged to the atmosphere from GWTF operations will not exceed the calculated emission rate limits specified in Table 9-1.

- Phase C—Capture and treat a sufficient portion of the dissolved phase plume beyond the hotspot to provide for aquifer cleanup within 100 years of the date of ROD signature. For aboveground treatment processes using reinjection of treated effluent, treatment shall be designed to reduce the VOC concentration to below MCLs. If an MCL does not exist, the contaminant concentration will be such that the total excess cancer risk posed by the groundwater will be within the acceptable range of 10^{-4} to 10^{-6}. Volatile organic compounds discharged to the atmosphere from GWTF operations will not exceed the calculated emission rate limits specified in Table 9-1.

- Institutional controls and groundwater monitoring—Institutional controls shall be implemented to protect current and future users from health risks associated with ingestion of groundwater containing COC concentrations greater than MCLs or 10^{-4} to 10^{-6} risk-based concentrations for contaminants without MCLs. Institutional controls shall be maintained until COC concentrations fall below MCLs or 10^{-4} to 10^{-6} risk-based concentrations for contaminants without MCLs.

10. STATUTORY DETERMINATIONS

The selected remedy meets the statutory requirements of Section 121 of CERCLA, as amended by the Superfund Amendments and Reauthorization Act, and to the extent practicable, the NCP. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 Protection of Human Health and the Environment

10.1.1 Protection of Human Health

The selected remedy protects human health through aboveground treatment and reinjection of treated groundwater to restore much if not all of the affected aquifer to drinking water quality within 100 years. Removing contaminants will prevent further degradation of groundwater and will be protective of future use. Treated water will be reinjected into the aquifer and will meet appropriate performance standards as determined during design. Any short-term threats associated with the selected remedy will be addressed by engineering controls and standard health and safety practices.

10.1.2 Protection of the Environment

A qualitative/semiquantitative ecological risk assessment indicated that no exposure pathways for ecological receptors are present under current conditions. Potential future exposure could occur primarily through use of contaminated water for crop irrigation. A simplified exposure scenario was evaluated for an herbivorous rodent in this future scenario. The scenario indicated that radiological doses from exposure to TAN groundwater used for crop irrigation would be insignificant in comparison to the radiological dose received from background sources. However, at the level of analysis performed in the risk assessment, the nature of potential adverse effects from Sr-90 cannot be fully evaluated. Furthermore, exposure to other COCs would be sufficiently low that no adverse effects would be expected in rodents occupying the irrigated cropland. Effects on organisms at higher trophic levels would also be expected to be insignificant.

Nevertheless, the selected remedy provides greater protection for ecological receptors in the future use scenario by reducing the levels of contaminants in water that might be used for irrigation in that scenario. Short-term effects on ecological receptors resulting from implementation of the selected remedy are also not expected to be significant. The selected remedy should not result in short-term adverse effects on the environment at TAN and will minimize adverse environmental effects that could occur as a result of future use of the TAN groundwater.

10.2 Compliance with ARARS

The selected remedy will comply with all Federal ARARs and promulgated State ARARs that are more stringent than Federal ARARs. A detailed list of ARARs for the selected alternative is shown in Table 10-1. A general description of the ARARs is summarized below in Section 10.2.1.[a]

10.2.1 Chemical-Specific ARARs

- State of Idaho Toxic Air Pollutants, Noncarcinogenic and Carcinogenic Increments (IDAPA 16.01.01.585 and .01.586). These requirements involve demonstration of preconstruction compliance with Toxic Air Pollutants emission screening levels. If the emissions exceed the screening levels, then model results must show compliance with the acceptable air concentration limits for carcinogens (AACC) at the INEL boundary (chronic exposure) and acceptable air concentration (AAC) limits for noncarcinogens at the public highway for a short term exposure. If model results indicate that the AACC or AAC will be exceeded, best available control technology must be applied at the source.

a. Citation of the Idaho Waste Management Regulations incorporate by reference the federal hazardous waste regulations.

Table 10-1. *Summary of ARARs for Alternative 4.*

Requirements	Citation	ARAR type		
		Action	Chemical	Location
CAA and Idaho Air Regulations				
Idaho Air Pollutants noncarcinogens	IDAPA 16.01.01.585		✓	
Idaho Air Pollutants carcinogens	IDAPA 16.01.01.586		✓	
NESHAPs - < 10 mrem/yr	40 CFR 61.92		✓	
NESHAPs - monitoring	40 CFR 61.93	✓		
ID Fugitive Dust	IDAPA 16.01.01.650 and .651	✓		
RCRA and HWMA				
Generator Standards	**IDAPA 16.01.05.006**			
Hazardous Waste Determination	40 CFR 262.11	✓		
General Facility Standards	**IDAPA 16.01.05.008**			
General Waste Analysis	40 CFR 264.13	✓		
Location Standards	40 CFR 264.18 (a) and (b)			✓
Preparedness and Prevention	40 CFR 264.31-.37	✓		
Closure Performance Standard	40 CFR 264.111	✓		
Disposal/Decontamination	40 CFR 264.114	✓		
Use/Management of Containers	40 CFR 264 Subpart I	✓		
Tank Systems	40 CFR 264 Subpart J	✓		
Miscellaneous Units	40 CFR 264 Subpart X	✓		
Air Emission Standards for Process Vents	40 CFR 264 Subpart AA	✓		
Land Disposal Restrictions	IDAPA 16.01.05.011	✓		
RCRA	Section 3020		✓	
UIC				
Idaho Rules for the Construction and Use of Injection Wells	IDAPA 37.03.03	✓	✓	
ID Public Drinking Water				
MCLs (numerical standards only)	IDAPA 16.01.08.050.02 and .05		✓	
Secondary MCLs (numerical standards only)	IDAPA 16.01.08.400.03		✓	
National Historic Preservation Act				
Assessing information needs	36 CFR 800.4(a)(1)(i),(iii)(a)(2)			✓
Locating Historic Properties	36 CFR 800.4(b)			✓
TBCs				
Radiation Protection of the Public and the Environment	DOE Order 5400.5	✓		
Fire Protection	DOE Order 5480.7A	✓		
Radioactive Waste Management	DOE Order 5820.2A	✓		

- National Emission Standards for Hazardous Air Pollutants (40 CFR 61.92) regulating emissions of radionuclides from DOE facilities. Emissions of radionuclides other than radon to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/yr.

- Safe Drinking Water Act, Underground Injection Control Program as incorporated into Idaho Rules and Regulations for the Construction and Use of Injection Wells (IDAPA 37.03.03), and Section 3020 of RCRA. The UIC regulation establishes standards for the quality of fluids discharged to Class V injection wells.

  In addition, Section 3020 of RCRA allows reinjection of groundwater containing hazardous constituents above regulatory limits into the aquifer from which it was withdrawn and treated as part of a CERCLA response action if the water quality has been substantially improved, and if the remedy will be protective of human health and the environment upon completion of the response action. The selected remedy employs extraction, treatment, and reinjection of process effluent, which substantially improves the condition of the aquifer and meets the substantive intent of the UIC and RCRA regulations.

- State of Idaho Drinking Water Standards (IDAPA 16.01.08.050.02, .05, and 16.01.08.400.03). These standards establish primary and secondary drinking water standards, referred to in this document as MCLs.

10.2.2 Action-Specific ARARs

- National Emission Standards for Hazardous Air Pollutants emission monitoring and test procedures (40 CFR 61.93). An operator of a source with radioactive (tritium) emissions under 0.1 mrem/yr is required to perform periodic confirmatory measurements to confirm low emissions.

- State of Idaho Rules for Control of Fugitive Dust (IDAPA 16.01.01.650 to .651) specifies that all reasonable precautions be taken to prevent the generation of fugitive dust.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.006, Hazardous Waste Determination (40 CFR 262.11) specifies substantive standards for the determination and classification of hazardous wastes.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, General Waste Analysis (40 CFR 264.13) contains substantive requirements for analysis of hazardous waste.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, Preparedness and Prevention (40 CFR 264.31-.37) contains substantive standards which apply to the design, operation, and maintenance for treatment and storage facilities involving hazardous wastes.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, Closure Performance (40 CFR 264.111) and Disposal or Decontamination (40 CFR 264.114) contain

substantive requirements for post operation closure and post closure of treatment and storage facilities involving hazardous wastes. These standards are relevant and appropriate for treatment process systems for extracted groundwater and sludge because it has been determined that the contaminated plume does not contain RCRA listed waste. These standards are applicable for the storage facility involving RCRA characteristic waste from the treatment of the extracted groundwater and sludge.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, Use and Management of Containers (40 CFR 264 Subpart I) contains substantive standards regarding hazardous waste container management and inspections for treatment and storage facilities involving hazardous wastes.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, Tank Systems (40 CFR 264 Subpart J) contains substantive standards dealing with design, leak control, inspections, and operating requirements for tank systems containing or processing hazardous waste.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, Miscellaneous Units (40 CFR 264 Subpart X) contains substantive requirements for miscellaneous treatment units that may be incorporated into future hazardous waste treatment designs based on process technology requirements resulting from treatability studies.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, Air Emission Standards for Process Vents (40 CFR 264 Subpart AA). This regulation requires, when influent total organic concentrations are greater than 10 ppmw, that total organic emissions from all facility process vents be below 3 lb/hr or reduction of total organic emissions by 95% by weight be maintained by use of a control device.

- State of Idaho Land Disposal Restrictions, IDAPA 16.01.05.011. Hazardous waste generated from the treatment process are subject to the substantive requirements of land disposal restrictions (LDRs) in effect at the time of ROD signature. Land disposal restrictions do not apply to treated groundwater reinjected into the same aquifer. Storage of hazardous or mixed waste generated from groundwater treatment constitutes permissible storage for the purpose of accumulating sufficient quantities to facilitate treatment and disposal. In the event that hazardous or mixed waste treatment residues are removed from storage for treatment/disposal at the INEL, LDR compliance may be addressed through the INEL Federal Facility Compliance Act Site Treatment Plan and Consent Order.

- Safe Drinking Water Act, Underground Injection Control Program as incorporated into Idaho Rules and Regulations for the Construction and Use of Injection Wells. IDAPA 37.03.03 establishes substantive monitoring requirements for Class V injection wells.

10.2.3 Location-Specific ARARs

- National Historic Preservation Act [36 CFR 800.4(a)(1)(i), (iii)(a)(2), and .4(b)] requires assessing information needs and locating historic properties, and applies when locating treatment systems outside the TAN facility fence.

- State of Idaho Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, IDAPA 16.01.05.008, General Facility Standards [40 CFR 264.18, (a) and (b)] contain substantive design considerations for locating hazardous waste treatment and storage facilities within a floodplain or seismic area.

10.2.4 Other Criteria, Advisories, or Guidance To-Be-Considered

- To-be-considered, action-specific material is contained in DOE Orders 5400.5, "Radiation Protection of the Public and the Environment," 5480.7A, "Fire Protection" and 5480.2A, "Radioactive Waste Management."

10.3 Cost Effectiveness

The selected remedy is cost effective and provides overall protection of human health and the environment proportional to duration of the remedy.

10.4 Use of Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Possible

U.S. Department of Energy, EPA, and IDHW have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for this final remedial action. The agencies have determined that this selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost, while also considering the statutory preference for treatment as a principal element and considering State and community acceptance. The selected remedy for OU 1-07B is intended to help prevent further degradation of the groundwater by containing and treating the source and by extracting and treating the dissolved phase plume.

10.5 Preference for Treatment as a Principal Element

By treating the contaminated groundwater using one or more technologies, such as air stripping, carbon adsorption, or ion exchange, the selected remedy satisfies the statutory preference in which treatment, as a principal element, permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances.

11. DOCUMENTATION OF SIGNIFICANT CHANGES

In the year since the Proposed Plan was released to the public, additional groundwater sampling results and the development of new and innovative treatment technologies have allowed improvements to be made in the evaluation of alternatives and the site groundwater model. As a result of this, the model predicts that the dissolved portion of the TCE plume (25 to 5,000 μg/L) can be remediated in less time and expense than previously indicated. Specifically, Alternative 4 can now be implemented at a pumping rate and for a time period comparable with that presented for Alternative 3, which was

the preferred alternative listed in the Proposed Plan. Remediation under Alternative 4 will be completed in less than 100 years and cost approximately $30 million.

In conjunction with Alternative 4, several innovative technologies, as described in Section 9, will be field tested to determine their applicability in treating the VOCs in the groundwater. If any of these alternate technologies prove more effective and represent a cost savings, the most cost-effective technology will be implemented. The selection of a substitute technology instead of the pump and treat technology described in this ROD would only be made after appropriate public evaluation of the benefits derived from changing the remedial action.

12. TEST AREA NORTH TRACK 1 NO ACTION SITES

The following sections of this ROD summarize information on the group of no action sites at TAN agencies identified by the DOE, EPA, and IDHW as posing acceptable risk to human health.

The typical Superfund site is often an obvious disposal site that contains hazardous wastes that have leaked into underlying soils and groundwater. In these cases, the location and boundaries of areas of contaminant concentrations can be readily identified. Many sites at the INEL do not fit into this typical category. Instead, they fall into the category of historical sites that have low or unknown quantities of residual contamination. These sites are termed low probability hazardous sites. For typical low probability hazardous sites, either the location and quantities of hazardous substances disposed of or leaked are unknown or there is significant uncertainty in the actual conditions.

In accordance with the FFA/CO, the agencies have evaluated the potential for contamination at the low probability hazardous sites. The evaluation process involved collecting and interpreting existing data to determine whether the site posed an acceptable or unacceptable risk. The information was then assembled into a decision document that consisted of a series of questions, forms, tables, and a qualitative risk assessment. This screening approach provided for the efficient use of available resources and for a rigorous process to evaluate the risks from these sites to determine whether additional investigation was required. This evaluation process was then used to determine whether (a) the site poses a clear risk that requires an Interim Action, (b) the site should be further investigated under CERCLA, (c) the site should be referred to another State or Federal program, or (d) the source does not appear to pose a risk to human health or the environment and therefore requires no action.

Over 40 sites at TAN fall into the category of low probability hazardous sites. Of these, the 30 sites discussed in the following sections have been evaluated and are proposed for No Action under CERCLA. The sites have been arranged into three groups: underground storage tanks, soil contamination sites, and wastewater disposal sites. The evaluation of all of these sites has included record reviews, document searches, employee interviews, site visits, field screening using portable field instruments, and/or soil sampling where appropriate. The evaluations indicate that these areas pose an acceptable risk to human health or the environment. A brief description and summary of each site is presented below.

12.1 Underground Storage Tanks

The following 18 former underground storage tank sites were evaluated as low probability hazardous sites. Except where noted, all of the tanks, their contents, and associated piping have been removed. All of the tank sites have been backfilled with new soil and restored for unrestricted use. In many cases, the tank and the associated piping have been recycled as scrap metal.

Several of the tank sites had petroleum-related organic contamination (i.e., benzene, toluene, ethylbenzene, and xylene) in the site soil below the excavation. In each case, a risk evaluation determined that the residual soil concentration for these contaminants did not exceed the 10^{-6} (1 in 1,000,000) risk-based concentrations for the air volatilization, soil inhalation, soil ingestion, or groundwater ingestion exposure routes.

OU 1-02, IET-01 [Underground Storage Tank (TAN-318)]. IET-01 is a former 5,000-gallon gasoline tank installed in 1958 and last used in 1965. The tank contents were removed in September 1991. The tank and the associated piping were removed in August 1992.

There were no holes in either the tank or the associated piping, and no visually stained or discolored soil was observed in the tank excavation. Field screening during the tank removal and the results of soil analyses from the excavation detected no organic contamination.

OU 1-02, IET-05 [Underground Storage Tank (TAN-1714)]. IET-05 is a former 550-gallon underground tank used for storage of fire-fighting foam (a biodegradable and nonhazardous material only) from 1958 to 1961. The tank contents were sampled and analyzed for organic and inorganic contaminants. No contaminants were detected at levels that exceed the 10^{-6} risk-based concentrations. The storage tank and its associated piping were removed in 1990.

There were no holes in either the tank or the associated piping, and no visually stained or discolored soil was observed in the tank excavation. No soil samples were collected beneath the tank because the tank contents were determined to be nonhazardous and no releases from the tank were found during removal, based on visual observations and field screening.

OU 1-02, IET-09 [Underground Storage Tank (TAN-316)]. IET-09 is a former 550-gallon lube oil tank installed in 1958 and last used in 1960. Sample analyses of the tank contents detected typical petroleum constituents and elevated levels of barium. The tank contents were removed in September 1991 and disposed of as a hazardous waste. The tank and the associated piping were removed in October 1991.

There were no holes in either the tank or the associated piping, and no visually stained or discolored soil was observed in the tank excavation. No releases have ever been reported and none are known to have occurred. Field screening during the tank removal and the results of soil analyses from the excavation detected no organic or inorganic contamination.

OU 1-02, IET-10 [Diesel Fuel Underground Storage Tank (TAN-1712)]. IET-10 is a former 30,000-gallon underground tank used for storage of diesel fuel from 1957 to 1989. Removal of the storage tank, its contents, and the associated piping were completed in 1990. Two nearby tanks, their contents, and their associated piping were also removed in 1990. No holes were observed in the tank or the associated piping during excavation. The analytical results from soil samples taken from the tank excavation detected only 2.3 parts per million (ppm) of xylene.

A risk evaluation was done to determine the risk-based soil concentrations (backward calculations) of xylene required at the site to pose an unacceptable risk. The risk evaluation estimated that xylene concentrations in the soil would need to be 6,400 ppm to exceed an HQ of 1 for the soil ingestion, air volatilization, air inhalation, or groundwater ingestion exposure routes.

OU 1-02, IET-11 [Heating Oil Underground Storage Tank (TAN-1713)]. IET-11 is a former 20,000-gallon underground tank used for storage of diesel fuel from 1957 to 1989. Removal of the

storage tank, its contents, and the associated piping were completed in 1990. Two nearby tanks, their contents, and their associated piping were also removed in 1990.

No holes were observed in the tank or the associated piping during the excavation. The analytical results from soil samples taken from the tank excavation detected only 0.08 ppm of toluene, 0.06 ppm of ethylbenzene, and 2.1 ppm of xylene.

A risk evaluation was done to determine the risk-based soil concentrations (backward calculations) of toluene, ethylbenzene, and xylene required at the site to pose an unacceptable risk. The risk evaluation estimated that xylene concentrations in the soil would need to be 1,310 ppm, 1,810 ppm, and 7,320 ppm respectively to exceed an HQ of 1 for the soil ingestion, air volatilization, air inhalation, or groundwater ingestion exposure routes.

OU 1-02, LOFT-05 [Fuel Tanks (TAN-767 A and B)]. LOFT-05 is the site of two 35,000-gallon underground tanks used for storage of heating oil from the mid 1950s to 1991. The tank contents were removed in 1991. However, the tanks and associated piping remain in place pending future use.

All available drawings and documentation indicate that the tanks were designed and used for the storage of fuel oil only. Personnel interviews also support that the tanks were used only to store fuel oil for heating purposes. In addition, no releases have ever been recorded and none are known to have occurred.

OU 1-02, LOFT-06 [Tank east of TAN-631 (TAN-765)]. LOFT-06 is a former 2,000-gallon underground tank used from 1958 to 1963. The tank was designed to store waste jet fuel and diesel-contaminated wastewater. However, all available information indicates the tank was only used for diesel-contaminated wastewaters.

Available drawings and documentation indicate that the tank contents were removed about 1965 and the tank was filled with sand. The site is currently covered by an asphalt road and parking lot. No surface contamination was visible in a 1966 aerial photograph before the asphalt road was built. Geophysical surveys performed in 1990 and 1993 did not locate the tank. No releases have ever been recorded and none are known to have occurred during the tank's 5-year period of operation.

OU 1-02, LOFT-08 [Underground Storage Tank (TAN-764)]. LOFT-08 is a former 15,000-gallon tank installed in 1958 and last used in 1963. Records indicate the tank was intended for storage of potentially radioactively contaminated petroleum jet fuel, but the project was cancelled in 1961 before the jet engines were tested. Therefore, the tanks were likely never used for their intended purpose. In January 1990, the LOFT-08 tank and the associated piping were removed.

No holes were observed in the tank, and field screening detected no organic contamination in the site soil. The analytical results from soil samples collected from the tank excavation detected only 2 ppm of toluene, 22 ppm of ethylbenzene, and 0.1 ppm of xylene.

A risk evaluation was done to determine the risk-based soil concentrations (backward calculations) of toluene and xylene required at the site to pose an unacceptable risk. The risk evaluation estimated that toluene, ethylbenzene, and xylene concentrations in the soil would need to be 54,000, 27,000, and 540,000 ppm, respectively, to exceed an HQ of 1 for the soil ingestion, air volatilization, air inhalation, or groundwater ingestion exposure routes.

OU 1-01, TSF-01 [Underground Storage Tank (TAN-1702)]. TSF-01 is a former 3,000-gallon diesel fuel tank installed in 1953 and last used in 1985. A pipe leak in 1983 reportedly released

approximately 500 gallons of diesel fuel into the surrounding soil. The pipe was replaced in 1983. The tank, its contents, and the associated piping were then removed in September 1991. No holes were observed in the tank or the associated new piping during the excavation. Approximately 73 m^3 (96 yd^3) of contaminated soil were removed from the site. The analytical results from soil samples collected from the excavation detected only 2 ppm of ethylbenzene and 9 ppm of xylene.

A risk evaluation was done to determine the risk-based soil concentrations (backward calculations) of ethylbenzene and xylene required at the site to pose an unacceptable risk. The risk evaluation estimated that ethylbenzene and xylene concentrations in the soil would need to be 27,000 and 540,000 ppm, respectively, to exceed an HQ of 1 for the soil ingestion, air volatilization, air inhalation, or groundwater ingestion exposure routes.

OU 1-02, TSF-13 [Underground Storage Tank North of TAN-610 (TAN-1221)]. TSF-13 is a former 550-gallon gasoline tank. Records indicate the tank was installed in the early 1950s to supply a fire-pump engine. The tank and its contents were removed about 1980.

No releases have ever been recorded and none are known to have occurred during the tank's operation. Geophysical surveys performed in 1993 did not locate the tank. A soil boring, completed in 1993 at the former tank site, detected no organic vapors in the site soil. Also, no visually stained or discolored soil was observed in the boring.

OU 1-02, TSF-14 [Underground Storage Tank (TAN-777B)]. TSF-14 is a former 12,000-gallon tank used for the storage of heavy diesel fuel from 1954 to 1975. The tank, its contents, and the associated piping were removed in 1991.

No holes were observed in the tank or the associated piping. Some radioactive soils were present above the tank from another pipe and some diesel-contaminated soil was present below the fill pipe. All soil contamination was removed. The analytical results of soil samples from the excavation detected only 0.55 ppm of benzene, 0.77 ppm of toluene, 2.2 ppm of ethylbenzene, and 0.96 ppm of xylene.

A risk evaluation was done to determine the risk-based soil concentrations (backward calculations) of benzene, toluene, ethylbenzene, and xylene required at the site to pose an unacceptable risk. The risk evaluation estimated that benzene concentrations in the soil would need to exceed 197 ppm to pose a 1×10^{-6} excess cancer risk to soil ingestion, air inhalation, air volatilization, or ingestion of groundwater exposure routes and that toluene, ethylbenzene, and xylene concentrations in the soil would need to be 40,000, 2,000, and 4,000,000 ppm, respectively, to exceed an HQ of 1 for the soil ingestion, air volatilization, air inhalation, or groundwater ingestion exposure routes.

OU 1-02, TSF-15 [Underground Storage Tank (TAN-779)]. TSF-15 is a former 3,000-gallon fuel oil tank that contained diesel fuel. Records indicate the tank was installed in 1963 and last used in 1975. The tank, its contents, and the associated piping were removed in August 1990.

No holes were observed in the tank, and field screening detected no organic contamination in the site soil. No visually stained or discolored soil was observed in the tank excavation. The results from soil sample analyses show that no organic contaminants were present in the site soil.

OU 1-02, TSF-24 [Underground Storage Tank (TAN-775)]. TSF-24 is a former 10,000-gallon tank planned to store jet engine fuel between 1955 and 1960. The tank, associated piping, and some soil with detectable contamination were removed in September 1990.

No holes were observed in the tank, and field screening detected no organic contamination in the site soil around the tank piping. No visually stained or discolored soil was observed in the tank excavation. The results from soil sample analyses detected no organic contamination.

OU 1-02, TSF-32 [Underground Storage Tank (TAN-601S)]. TSF-32 is a former 170-gallon tank used to supply heating oil. Records indicate the tank was installed in the mid-1950s and last used in the late 1950s. The tank and associated piping are believed to have been removed sometime between the late 1950s and 1967.

The site is currently covered by an asphalt road and parking lot. Geophysical surveys performed in 1990 and 1991 did not locate the tank, which supports the assumption that the tank had been previously removed. No releases have ever been recorded and none are known to have occurred during the tank's brief period of operation.

OU 1-02, TSF-33 [Underground Storage Tank (TAN-602E)]. TSF-33 is a former 10,000-gallon diesel fuel tank. Records indicate the tank was installed in 1959 and last used in 1960 when the ANP project was terminated. The tank, its contents, and the associated piping were removed in August 1990.

No holes were observed in the tank, and field screening detected no organic contamination in the site soil. No visually stained or discolored soil was observed in the tank excavation. The results from soil sample analyses detected no organic contamination.

OU 1-02, WRRTF-09 [Underground Storage Tank (TAN-788)]. WRRTF-09 is a former 2,500-gallon diesel fuel tank used to supply an emergency generator. Records indicate the tank was installed in 1962 and last used in 1978. The tank, its contents, and the associated piping were removed in August 1990.

No holes were observed in the tank, and field screening detected no organic contamination in the tank excavation. No visually stained or discolored soil was observed in the tank excavation. The results from soil sample analyses detected no organic contamination.

OU 1-02, WRRTF-10 [Underground Storage Tank (TAN-644)]. WRRTF-10 is a former 550-gallon gasoline tank used to supply an emergency generator. Records indicate the tank was installed in 1955 and last used in 1966. The tank, its contents, and the associated piping were removed in August 1990.

No holes were observed in the tank, and field screening detected no organic contamination in the site soil. No visually stained or discolored soil was observed in the tank excavation. The results from soil sample analyses detected no organic contamination.

OU 1-02, WRRTF-12 [Diesel Fuel Underground Storage Tank (TAN-1706)]. WRRTF-12 is a former 1,000-gallon diesel fuel tank used to supply an emergency generator. Records indicate the tank was installed in the late 1950s and last used in 1975. The tank, its contents, the associated piping, and some contaminated soil around the tank were removed in August 1990.

No holes were observed in the tank, and field screening detected some organic contamination in the site soil around the tank piping. The analytical results from soil samples taken from the tank excavation detected 0.6 ppm of toluene, 0.8 ppm of ethylbenzene, and 7 ppm of xylene.

A risk evaluation was done to determine the risk-based soil concentrations (backward calculations) of toluene, ethylbenzene, and xylene required at the site to pose an unacceptable risk. The risk evaluation estimated that toluene, ethylbenzene, and xylene concentrations in the soil would need to be 40,000, 2,000, and 4,000,000 ppm, respectively, to exceed an HQ of 1 for the soil ingestion, air volatilization, air inhalation, or groundwater ingestion exposure routes.

12.2 Potential Soil Contamination Sites

The following 9 low probability hazardous sites were classified as potential soil contamination sites. Many of these sites were only suspected of having received hazardous and/or radioactive waste during the initial site identification, and the subsequent evaluation process has determined that no such disposal activities had occurred. Other sites are known to have had some contamination present, and the subsequent evaluation process has either documented the removal of the contamination or determined that contaminant concentrations remaining at the specific site(s) are at levels that pose an acceptable risk to human health or the environment.

OU 1-06, LOFT-01 [Diesel Fuel Spills (TAN-629)]. LOFT-01 is the site of several diesel spills that occurred when a diesel tank overflowed during filling between 1982 and 1986. The fuel oil flowed into a culvert and pooled in a ditch. The contaminated soil in the ditch was excavated and removed in 1990.

Field screening and soil sampling detected only some petroleum-related organic contamination. The analytical results from soil samples detected 4.4 ppm of toluene, 2.8 ppm of ethylbenzene, and 9.3 ppm of xylene. No other hazardous or radioactive materials are known or suspected to be present.

A risk evaluation was done to determine the risk-based soil concentrations (backward calculations) of toluene, ethylbenzene, and xylene required at the site to pose an unacceptable risk. The risk evaluation estimated that toluene, ethylbenzene, and xylene concentrations in the soil would need to be 17,000, 8,380, and 116,000 ppm, respectively, to exceed an HQ of 1 for the soil ingestion, air volatilization, air inhalation, or groundwater ingestion exposure routes.

OU 1-01, LOFT-03 (Rubble Pit south of LOFT Disposal Pond). LOFT-03 was used on an irregular basis for surface disposal of construction debris such as concrete, metal, and wood from the late 1960s to the early 1970s. Most of the construction debris was removed in 1987 or 1988. The remaining debris was removed in 1991 and disposed of at the Central Facility Area (CFA) Landfill.

Hazardous or radioactive materials are not known or suspected to have been disposed of at LOFT-03. Field inspections of the site and field screening of the debris and soil during cleanup operations did not reveal any organic or radiological contamination.

OU 1-06, LOFT-10 [Sulfuric Acid Spill (TAN-771)]. LOFT-10 was a 200-gallon sulfuric acid spill that occurred in 1983. Approximately 0.4 m^3 (0.5 yd^3) of contaminated soil was excavated and disposed of at that time.

Site investigations and soil testing in 1991 showed that no acid remained in the shallow soil at this site. No visually stained or discolored soil was observed at the site. It is likely that the sulfuric acid was quickly neutralized by the naturally alkaline native site soil. Calculations show that only 0.5 m^3 (0.65 yd^3) of TAN soil would be required to neutralize 10-gallons of pure sulfuric acid. Except for

the sulfuric acid spill, no other hazardous or radioactive materials are known or suspected to have been disposed of at LOFT-10.

OU 1-01, LOFT-11 (Cryogen Pits). LOFT-11 is the site of three former concrete pits that were constructed in 1963. The pits were intended for the disposal of liquid nitrogen that was to be used as a coolant during the Liquid Cooled Reactor Experiment. The experiment was cancelled in 1967 before the pits were ever used.

Available site engineering drawings and records document the planned use and subsequent backfilling of the pits. Hazardous or radioactive materials are not known or suspected to have been disposed of at LOFT-11. The site is currently covered by the concrete floor of Building TAN-629.

OU 1-01, LOFT-14 (Asbestos Pipe). LOFT-14 was an abandoned metal pipe covered with asbestos insulation lying exposed on the ground. In July 1991, all the asbestos was removed from the pipe, packaged, and disposed of at the Asbestos Area at the Central Facilities Area Landfill. The metal pipe and the underlying soil were also disposed of at the CFA Landfill.

Except for the asbestos insulation, no other hazardous or radioactive materials are known or suspected to be present at the LOFT-14 site. Field inspections confirmed that no free asbestos fibers were visible in the surface soils after the pipe was removed.

OU 1-01, LOFT-15 (LOFT Buried Asbestos Pit). LOFT-15 is the former site of a construction materials burn pit used from as early as 1957 to as late as 1979. The construction debris was most likely concrete, metal, and wood and was disposed of and burned on an irregular basis. The pit was abandoned in 1979 and was covered with 0.6 to 1.2 m (2 to 4 ft) of soil. Most of the debris was removed in 1992 and was disposed of at the CFA Landfill.

Hazardous or radioactive materials are not known or suspected to have been disposed of at LOFT-15. Field inspections of the site and field screening of the debris and soil during cleanup operations did not reveal the presence of any organic or radiological contamination.

OU 1-01, TSF-04 (Gravel Pit/Acid Pit). TSF-04 is located in a former gravel pit used to dispose of construction debris such as concrete, metal, and wood from the 1950s to the mid 1970s. According to personnel interviews, the only hazardous material or waste disposed of in this area was one 55-gallon drum of sulfuric acid sometime between 1958 and 1959.

Although sampling was not conducted at TSF-04, a 1990 field inspection revealed no evidence of stressed vegetation or surface stains at the site. In addition, sulfuric acid would have been quickly neutralized by the naturally alkaline native soil. It has been calculated that only 0.49 m^3 (0.65 yd^3) of TAN soil would be required to neutralize 10 gallons of pure sulfuric acid. Any residual contaminants would have likely been removed by subsequent gravel quarrying activities. Except for the one drum of sulfuric acid, no other hazardous or radioactive materials are known or suspected to have been disposed of at TSF-04.

OU 1-02, TSF-25 [Underground Drain Sump East of TAN-609 (TAN-1737)]. TSF-25 is an unlined drain sump used to collect waste jet fuel and other products from static engine tests. Records indicate the sump was installed in 1955 to replace a tank that had been removed. The sump was abandoned in 1987 and the floor drain to the sump was filled with concrete.

Available drawings and information indicate the sump was used during the ANP project only to collect waste jet fuel from 1955 to 1961. Later use of the building did not require the use of the

sump. Therefore, except for jet fuel, no other hazardous or radioactive materials are known or suspected to have been disposed of at TSF-25. Organic vapors were detected in the soil adjacent to the sump; however, subsequent soil samples results detected no organic contamination. There is no planned future use for the sump.

OU 1-01, TSF-39 [Transite (Asbestos) Contamination]. TSF-39 is an area that contains small pieces of asbestos cement (transite) and is believed to be the result of the construction activities for LOFT. Field inspections have determined that the asbestos material is encapsulated in cement and is not likely to be released.

Hazardous or radioactive materials are not known or suspected to have been disposed of at TSF-39. Field inspections and field screening of the debris did not reveal the presence of any organic or radioactive contamination.

12.3 Wastewater Disposal Sites

The following three low probability hazardous sites are classified as wastewater disposal sites because they have been used to receive liquid waste discharges from the TAN area facilities. The subsequent valuation process has determined that none of the sites has received any hazardous or radioactive wastes and that any potential contaminants discharged to the sites have either been neutralized, biodegraded, or pose an acceptable risk to human health.

OU 1-09, WRRTF-02 [Two-Phase Pond (TAN-763)]. WRRTF-02 is an unlined surface water pond that had previously received waste from only the Two-Phase Loop experiments. This pond replaced the WRRTF-05 Injection Well that was abandoned in 1983. Waste from these experiments consisted of primarily steam condensate and process wastewater potentially containing demineralization or corrosion-inhibiting solutions.

No hazardous or radioactive contaminants are known to have been discharged to the pond. Review of engineering drawings indicates a checkvalve in the steam system would prevent any potential contaminants from draining into the pond. Although no soil sampling was conducted, site inspections revealed no evidence of contamination, stained soil, or stressed vegetation. It is believed that any demineralization or corrosion-inhibiting solutions discharged to the pond would have been neutralized by the naturally alkaline native soils or biodegraded.

As stated above, the WRRTF-02 pond replaced the WRRTF-05 Injection Well in 1983. Processes that generated the wastes that were discharged to this pond are not known to have changed significantly since the WRRTF-05 Injection Well was put into use. Therefore, although the WRRTF-02 pond was not sampled, some qualitative information regarding potential contamination in the pond may be gleaned from the WRRTF-05 sampling results. The results from two rounds of groundwater monitoring samples collected in 1994 from the former WRRTF-05 Injection Well detected only Co-60 at concentrations greater than acceptable risk levels. The presence of Co-60 in the WRRTF-05 Injection Well is from a one-time release in the mid-1960s and not the result of routine disposal activities at the WRRTF.

OU 1-09, WRRTF-03 (Evaporation Pond). WRRTF-03 is an unlined evaporation pond used to dispose of process water and cooling water from 1983 to the present. This pond replaced the WRRTF-05 Injection Well that was abandoned in 1983. Waste from these experiments consisted of primarily steam condensate and process wastewater potentially containing demineralization or

corrosion-inhibiting solutions. Records indicate that minor amounts of sulfuric acid, sodium hydroxide, and hydrazine were disposed of in the pond.

No hazardous or radioactive materials are known to have been discharged to the pond. Although no soil sampling has been conducted, records from 1985 and 1986 indicate that only low concentrations of inorganic contaminants were discharged to the pond. In addition, site inspections revealed no evidence of contamination, stained soil, or stressed vegetation. It is believed that any demineralization or corrosion-inhibiting solutions discharged to the pond would have been neutralized by the naturally alkaline native soils or biodegraded.

As stated above, the WRRTF-03 pond replaced the WRRTF-05 Injection Well in 1983. Processes that generated the wastes that were discharged to this pond are not known to have changed significantly since the WRRTF-05 Injection Well was put into use. Therefore, although the WRRTF-03 pond was not sampled, some qualitative information regarding potential contamination in the pond may be gleaned from the WRRTF-05 sampling results. The results from two rounds of groundwater monitoring samples collected in 1994 from the former WRRTF-05 Injection Well detected only Co-60 at concentrations greater than acceptable risk levels. The presence of Co-60 in the WRRTF-05 Injection Well is from a one-time release in the mid-1960s and not the result of routine disposal activities at the WRRTF.

OU 1-09, WRRTF-06 (Sewage Lagoon). WRRTF-06 is an unlined surface water pond that received nonhazardous sanitary and process wastes from 1984 to the present. This pond replaced the WRRTF-05 Injection Well that was abandoned in 1983. Waste from these experiments consisted of primarily steam condensate and process wastewater potentially containing demineralization or corrosion-inhibiting solutions. Records from 1982 to 1989 indicate that the sewage effluent to the WRRTF-05 Injection Well and WRRTF-06 pond contained only low concentrations of inorganic and organic compounds.

No hazardous materials are known to have been discharged to the pond. Although no soil sampling was conducted, site inspections revealed no evidence of contamination, stained soil, or stressed vegetation. It is believed that any demineralization or corrosion-inhibiting solutions discharged to the pond would have been neutralized by the naturally alkaline native soils or biodegraded.

As stated above, the WRRTF-06 pond replaced the WRRTF-05 Injection Well in 1983. Processes that generated the wastes that were discharged to this pond are not known to have changed significantly since the WRRTF-05 Injection Well was put into use. Therefore, although the WRRTF-06 pond was not sampled, some qualitative information regarding potential contamination in the pond may be gleaned from the WRRTF-05 sampling results. The results from two rounds of groundwater monitoring samples collected in 1994 from the former WRRTF-05 Injection Well detected only Co-60 at concentrations greater than acceptable risk levels. The presence of Co-60 in the WRRTF-05 Injection Well is from a one-time release in the mid-1960s and not the result of routine disposal activities at the WRRTF.

12.4 Decision Summary for the No Action Sites

The DOE has determined that no further action is needed for the miscellaneous sites in OUs 1-01, 1-02, 1-06, and 1-09 described in Sections 12.1 through 12.3. On the basis of the Track-1 evaluations, it was determined that no significant sources of contamination exist at these sites. Consequently, it was decided that these sites pose no unacceptable risks to receptors, and therefore no remedial actions are necessary.

The EPA approves of these no action decisions, and the IDHW concurs. Both the EPA and the IDHW have been involved in the review of the Track-1 reports, the proposed plan, this ROD, and other project activities such as public meetings.

12.5 Documentation of Significant Changes

The Proposed Plan that was released for Public Comment in May 1994 identified 30 Track 1 sites for no further action. The Track 1 process used historical and process information to evaluate the risk posed by each site. During the public comment period, however, new site data for TSF-36 indicated that contamination existed at the site. As a result, DOE, in conjunction with the EPA and IDHW, decided to delete TSF-36 from the list of Track 1 no further action sites in the ROD. Cleanup activities have been initiated at the site to reduce the threat of contaminant migration and the risk to human health and the environment. TSF-36 will be included in the WAG 1 OU 1-10 Comprehensive RI/FS to evaluate the site conditions and make appropriate remedial recommendations.